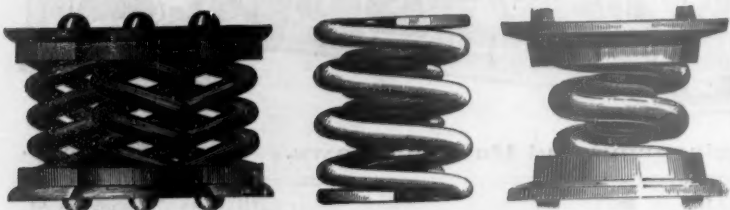






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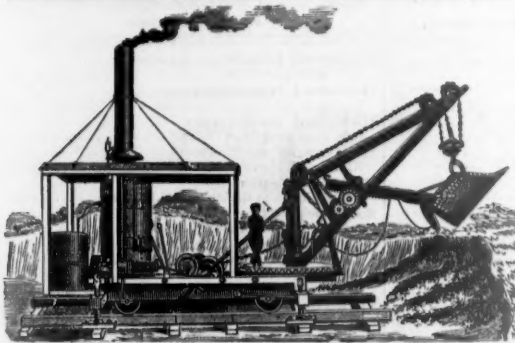
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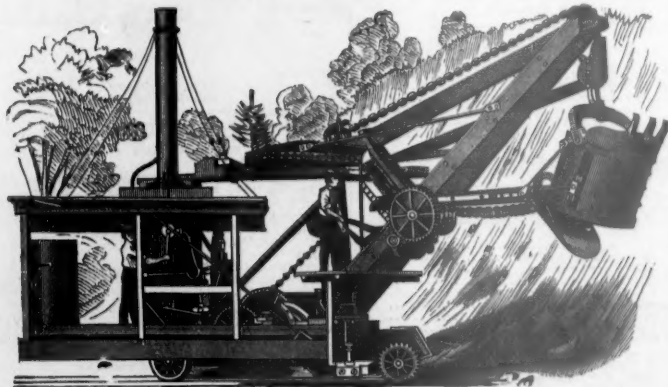
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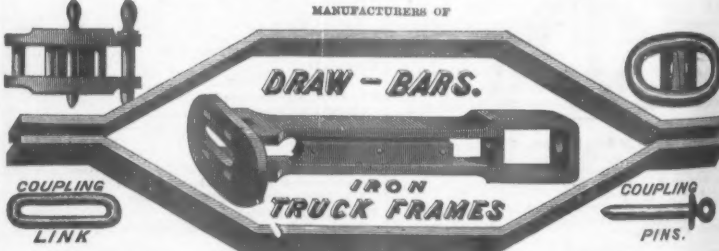
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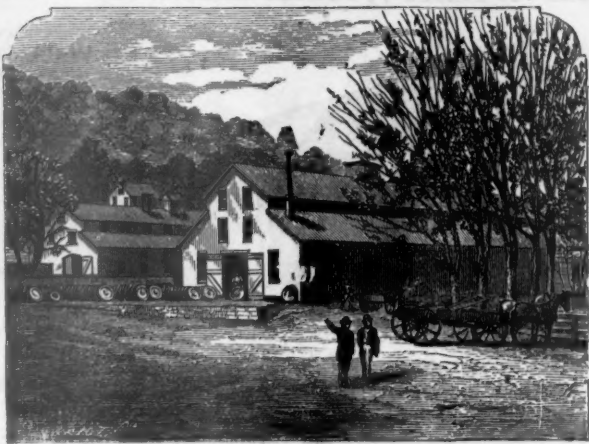
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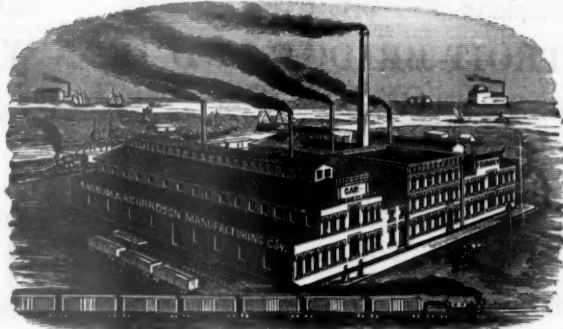
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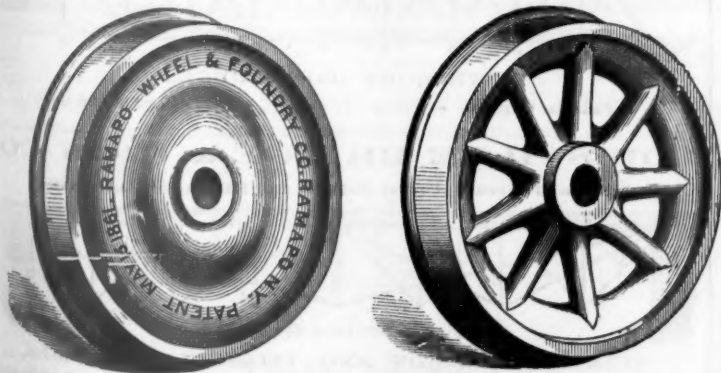
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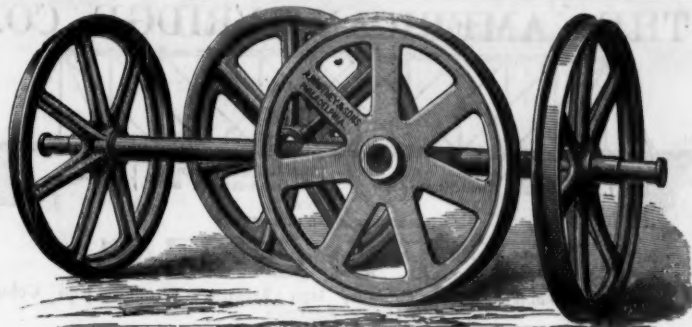
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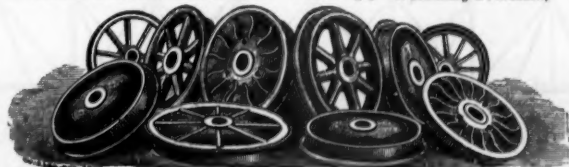
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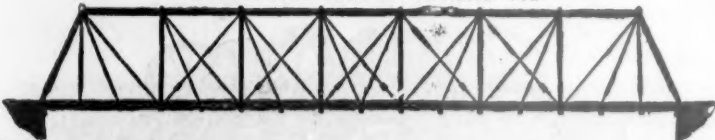
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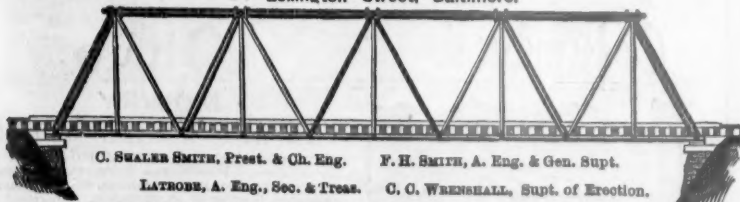
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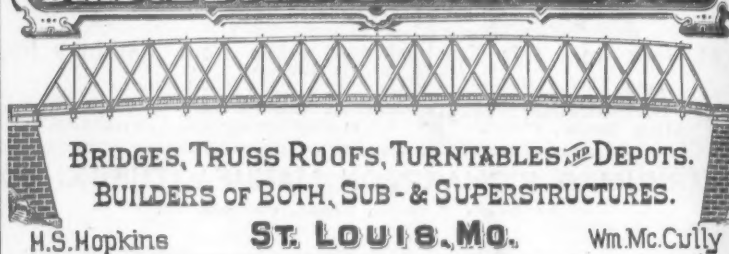


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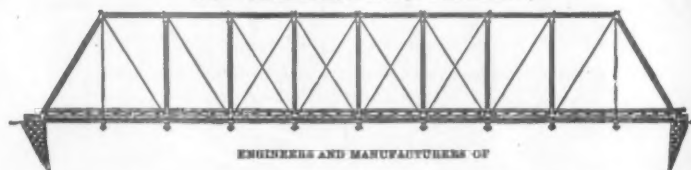
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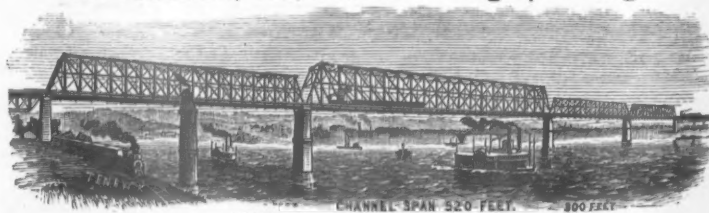
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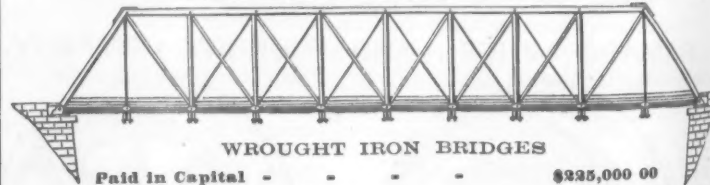
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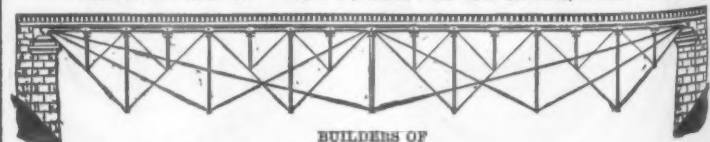


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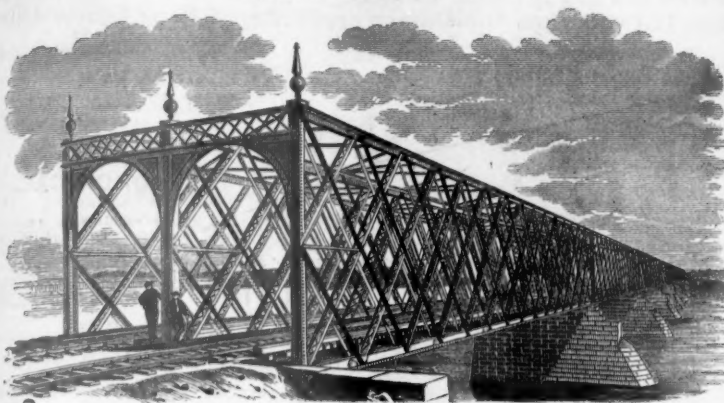
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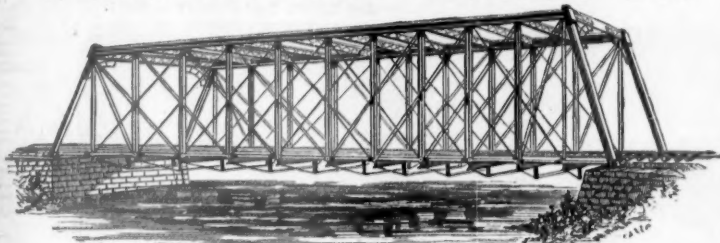


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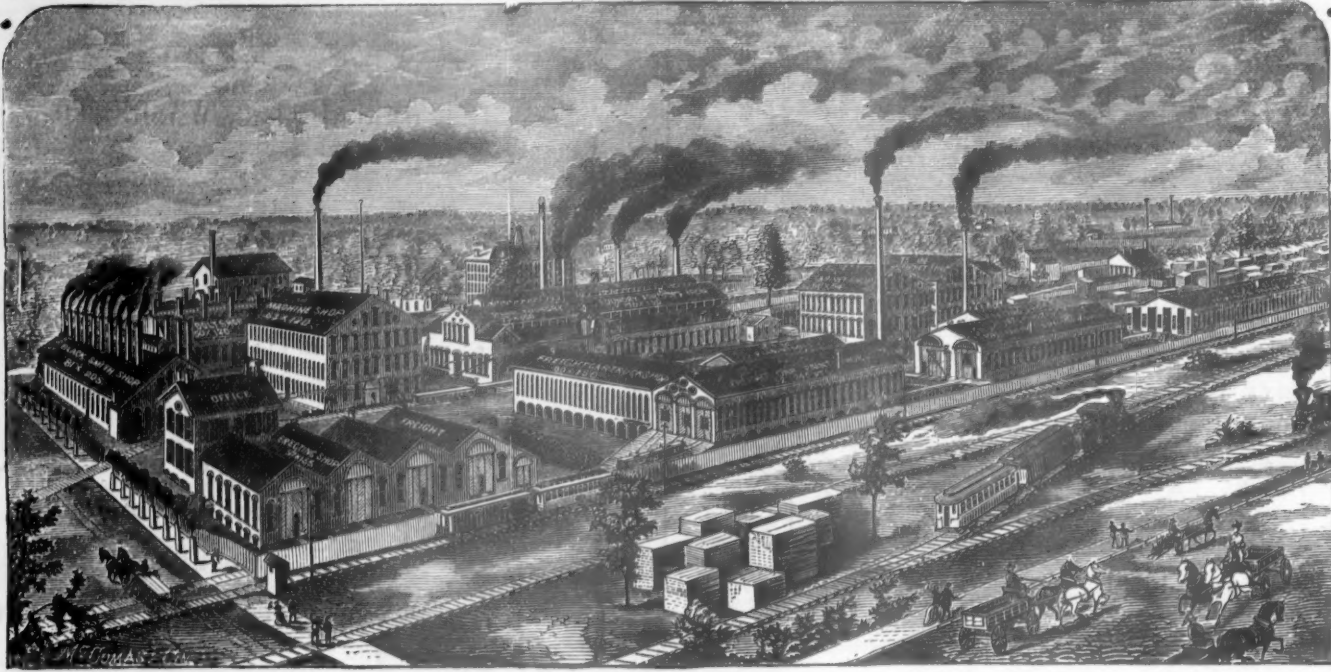
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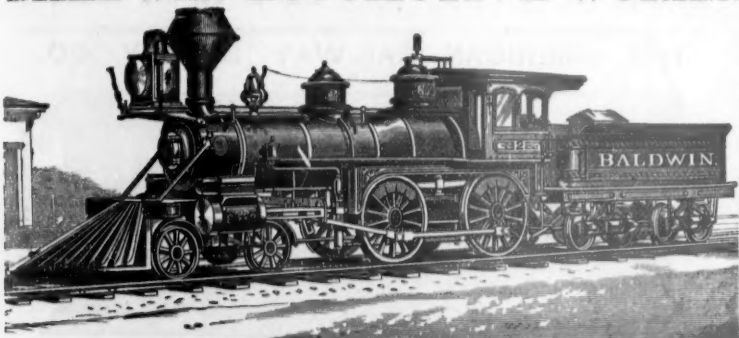
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FRIDAY, FEBRUARY 9, 1877.

## Axle-Centering Machine.

We are indebted to our enterprising contemporary, *Engineering*, for the engraving and the following description of this machine, which was built by the well-known engineers and machine-tool makers of Philadelphia, and was shown in the late Centennial Exhibition:

In this machine the axles, crank pins or shafts to be cut off square and centered, are held in powerful self-centering chucks, shown in Fig. 5, which admit shafts up to 8 in. in diameter. The bed *A* (see Figs. 1 and 2) of the machine sustains two movable carriages *B* and *C*, which can be fastened at any point upon it by means of bolts *a* playing in slots *b* upon its upper surface. These carriages serve as bearings in which revolve the self-centering chucks above mentioned. The driving gear consists of a cone, *D*, with three steps for a 4-in. belt keyed upon a splined shaft, *E*, which traverses the whole length

of the machine, passing through the carriage *B* but outside of *C*. Within the carriage *B* are two pinions, *o* and *o'*, (Fig. 2) of different diameters, playing upon the splined shaft *E* and driven by it. These gear with two spur wheels, *d* and *d'*, upon the intermediate shaft *F*, which has an internal clutch operated by the hand lever *L*, by means of which either spur may be engaged or both left free. This enables the above to change instantly from one speed to another without shifting the belt, or to stop the revolution of the chucks without waiting for the slower movement of the belt-shifter; it also gives six changes of speed. The intermediate shaft *F* has cut upon it a pinion, *F'*, which gears with a large spur wheel, *G*, keyed upon the boss of the chuck *H*. The carriage *C* has no driving gear attached to it, its chuck receiving the rotary motion of carriage *B* through the axle or shaft stamped in its jaws.

For convenience in placing axles or shafts in the chucks and in removing them, there are placed on the bed of the machine two stands which carry rollers, as seen at *I*, in Fig. 6; these rollers can be adjusted to suit shafts of any diameter. The tool slides *J* are placed one at each end of the shaft or axle to be cut, and outside of the carriages *B* and *C*. They are to be adjusted properly for cutting the shaft or axle to the desired length. The tool slides receive their motion from the splined shaft *E* by means of the worm screw *f*, worm wheel *K*, shaft *k*, pinion *l*, and internal gear *L*. This gear runs loose upon the cross slide screw *m* when not fastened by the pinch bolt *n* to the crank *N*.

The workman can therefore screw the cross slide back and forth at will by hand, can start his cut by hand, and then with single turn of the hand nut *Q*, Fig. 4, can join the pinch bolt

with the annular slot *P* of the internal gear *L*, binding it fast to the crank *N*, and thereby driving the tool slide *J* by power. Conversely when the tool has reached the centre, or the depth required to be cut, he has only to slacken the hand nut *Q*, and without changing his grasp withdraw the tool slide. A segment blade, *g*, under the tool serves to elevate or depress its points as required. By means of the double tool slide both ends of the shaft are cut off at once.

Each tool slide is provided with a centre drilling attachment arranged with a hinge joint, *O*, so that it may be thrown back out of the way when placing or removing an axle or shaft, and driven by flat or round belts, as preferred, on pulleys, *s* and *s'*, which are tightened by the mere action of bringing them down into position, so as to revolve the drill with the proper velocity. By means of the lever *L* the driving gear may be thrown out and the shaft remain stationary if preferred while drilling the centres. The gears are all neatly boxed over to avoid danger to the workman, and to keep out dirt and chips. The carriage and also the tool slides are made with ample trays and channels for receiving and removing the waste used in cutting.

## Regulations for Accounting for Fuel and Lights.

(Copyright, 1876, by the Railroad Gazette.)

The following rules are from a work by a railroad accountant entitled "Rules and Regulations for Railway Disbursements,"

livered opposite the number of the engine in the column for the day upon which the fuel was issued.

127. Great care must be exercised by road accountants and others, to see that the locomotives are always supplied with a sufficient quantity of tickets, of the proper denominations, and that those for different engines are not mixed together.

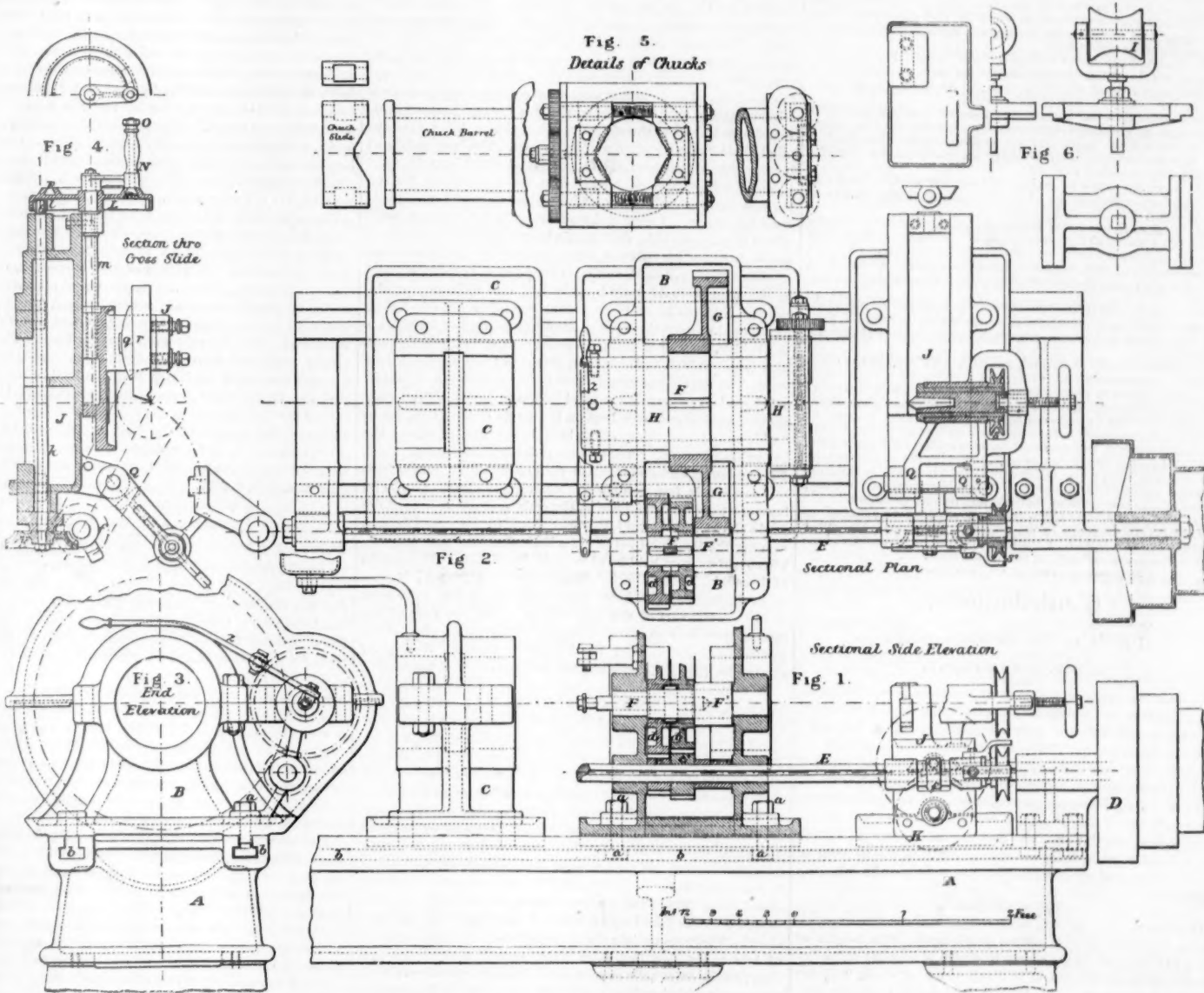
128. At the end of the month the tickets collected must be sent forward, without delay, in the ticket box, to the office of the principal shop for the division.

129. The tickets so returned to the principal shops are there assorted according to engines, and the amount consumed by each engine carefully ascertained, any error in the fuel books being corrected to agree with the tickets actually returned in the tin boxes.

130. The auditing clerks must promptly notify each person of any mistakes he may discover in the account written up by such person.

131. When the account has been duly audited as described, the books and boxes must forthwith be returned to the place from whence they were received.

132. The clerks auditing this account will, without delay, transmit to the Local Treasurer a statement of the quantity of fuel received by each engine at the different fuel stations, using for such purpose the usual blank [Form 41, Appendix], providing a column for the number of engine with columns for the stations where issued. This information is used in compiling the locomotive report. [Form 53, Appendix.]



MACHINE FOR CUTTING OFF AND CENTERING AXLES, &amp;c.,

By Ferris &amp; Miles, Philadelphia.

soon to be published. The work is more in the form of the Army Regulations than anything else to which we can compare it, every paragraph being numbered, and printed forms of the blanks used being given in the Appendix. The forms here referred to have not been copied, though the references are preserved:

## 119. "FUEL USED BY LOCOMOTIVES."

120. This account includes all fuel consumed by locomotive engines in active service.

121. The fuel used upon locomotives while in the shop undergoing repairs should, however, be charged up as a part of the cost of the said repairs.

122. No account whatever of the fuel used by locomotives while on the road or while switching should be entered in the distribution of material books kept at shops or storehouses.

123. For fuel taken for such purposes, rigidly enforce the collection of tickets from engines at the time of the delivery of the fuel to them, being particular to see that the ticket calls for the exact quantity of fuel delivered. Keep the ticket boxes locked.

124. Promptly report to the Superintendent of Machinery any engineer attempting to supply his engine with fuel without the delivery of the requisite tickets therefor.

125. Examine all tickets when received, to see that the number of engine printed thereon agrees with the number of the engine receiving the fuel.

126. The tickets, as collected, must be put in the fuel ticket box, after they have been entered on the book, which labor must be performed daily, as they are received. In entering them upon this book, be particular to enter them for fuel de-

133. A summary of the above statement should be immediately forwarded by the auditing clerk to the Purchasing Agent.

134. Upon the receipt of this statement a report of the quantity of fuel consumed by locomotives on each division of the road and the value thereof (as agreed upon) is certified to the Local Treasurer by the Purchasing Agent, to be credited to fuel on hand and charged to fuel used by locomotives on the different divisions.

## 135. "FUEL AND LIGHTS USED IN CARS."

136. This account includes the value of fuel used in heating all classes of cars, and the wages of such men as are employed exclusively in connection with the furnishing or attendance on account of fuel and lights for cars.

137. Also the cost of oil, kerosene, wicking, candles, etc., etc., used for lighting cars of all classes; also the same class of material consumed in lanterns of trainmen.

138. The cost for lights is charged up to this account on the distribution books at the time the material is sent out, to stations and elsewhere, from the different shops and storehouses having such material in charge.

139. The total amount charged to this account is apportioned to the different divisions of the road by the Local Treasurer, on the basis that the mileage of passenger, baggage, express, mail, business and caboose cars on the different divisions bears to the total mileage of such cars on the whole road.

140. No entry should be made on the distribution books at the shops and storehouses for fuel supplied to cars.

141. The person in charge of fuel stations is required to see that conductors furnish tickets for all fuel supplied to them for use on their trains. The tickets



thus collected must be forwarded to the Purchasing Agent, on the first day of each month, with the monthly fuel report specifying the fuel on hand and the fuel used for different purposes.

142. Fuel agents will report to the Purchasing Agent the name of any conductor unsupplied with fuel tickets.

143. When conductors cannot furnish fuel tickets, a written receipt [Form 53, Appendix] must be taken for the fuel delivered to them.

144. The quantity of fuel used on cars, reported to the Purchasing Agent by those in charge of fuel on the line of the road as specified above, is examined, audited and filed in the office of the Purchasing Agent.

145. Afterwards the Purchasing Agent will certify to the Local Treasurer the quantity furnished, to the different divisions, also the total value, the rate having been previously agreed upon; the amount of this report is then credited to fuel on hand and charged as above.

146. "FUEL AND LIGHTS USED AT STATIONS AND SHOPS."

147. This account embraces all fuel used in the freight and passenger offices and buildings, as specifically enumerated elsewhere herein.

148. It includes the cost of gas, oil, kerosene, candles, wicking, etc., expended in lighting the buildings and offices named above, or used in the lanterns of the employees immediately connected with them, including car repairers; also the amount consumed for signals, switches, tracks, etc., at stations, shops and elsewhere on the road not otherwise provided for herein.

149. The cost of material for lights at stations and shops is charged up to this account at the shops and storehouses at the time the material is sent out to stations and elsewhere from such shops and storehouses, a separate account being opened with each division supplied.

150. The fuel consumed exclusively for manufacturing purposes by blacksmiths, tinners, boiler makers, and others, in the buildings named, should be charged to the work or material the fuel was actually expended upon.

151. It embraces the fuel for warming or heating purposes in the class of buildings enumerated under the head of shops and engine houses, water stations and fuel sheds; also the fuel and lights consumed by stationary engines, steam shovels, pile-drivers, wrecking cars, etc.

152. No entry must be made on the distribution books at shops and storehouses for the fuel consumed chargeable to this account.

153. Persons in charge of fuel are required to collect receipts [Form 42, Appendix] for all fuel issued and chargeable to this account, and otherwise exercise a rigid supervision over all disbursements of this character, being particular to see that no fuel is expended that is not duly reported to the Purchasing Agent.

154. Each person in charge of fuel is required to report on the first day of each month, to the Purchasing Agent, the total quantity issued by him, as provided by the report [Form 43, Appendix].

155. This report is examined, audited, and filed in the office of the Purchasing Agent.

156. The quantity consumed on each division and the value of the same for each division (as agreed upon) are immediately certified by the Purchasing Agent to the Local Treasurer; the amount consumed is then charged up by the latter to the different divisions, fuel on hand being credited with the whole.

157. When the cost is not properly chargeable to any particular division, then a special charge should be made in the Purchasing Agent's statement for such disbursements, as, say, "Fuel and Lights used at Stations and Shops, Common."

158. The proportion of this common expense is charged up to the different divisions in the office of the Local Treasurer on the basis that the gross earnings of the different divisions bear to the gross earnings of the whole road.

## Contributions.

### Details of the Ashtabula Bridge.

BY EDW. S. PHILBRICK, C. E.

Feeling the incompleteness of the information given upon this subject in the public prints, and being unable to devote the time myself which a personal inspection would require, I sent my assistant, Mr. Albert H. Howland, who has had experience in designing a variety of bridge work, and whom I know to be a thorough and reliable man, to inspect the wreck in detail. From his notes made during over two weeks while the wreck was being removed, and from statements of Mr. Charles Macdonald, C. E., who had visited the wreck, I have the following facts, many of which will perhaps be new to your readers, and from which everyone can make his own deductions:

#### THE STRUCTURE.

This was a deck bridge, with two iron Howe trusses, each having fourteen panels of eleven feet length. The height of truss was 19 ft. 9 in. from centre to centre of chords; width between centres of trusses, 17 ft. 2 in.; width of deck, 25½ ft.; length between back walls, 158 ft. The bottom chords consisted each of five lines of bars, each 5 in. × 1½ in., flat side up and side by side, each line consisting of two bars, one over the other, except that the third line drops the bottom bar in 2½ panels at ends of trusses, and the second and fourth lines drop the bottom bar in 3½ panels at ends. Rectangular lugs were welded to top bars at panel points to fit into transverse grooves of the cast angle blocks. These bars are in lengths of three or four panels. Splices were made by hooks fitted to square lugs on ends of bars and clamped by ferules driven or shrunk on. These ferules clasp the hook, the spliced bar and the continuous bar all at once. The angle blocks at panel points were all cast-iron; bearing faces nearly plane but not planed. L-shaped lugs were originally cast on these faces 1½ in. long and ½ in. projection, to hold the braces in place, as these were originally put in, viz., with the top and bottom flanges of the I-beams of which all the braces were composed, being parallel with the plane of the truss. We are told by men who were employed in its erection, that when first put together some wedges were drawn on the false works, the braces being in the position above described, that the braces had been clamped at their intersections and these clamps parted, allowing the braces to buckle and the truss to sag. A few more wedges were drawn and it settled more, the braces getting some inches out of line. Mr. Stone was sent for and had it jacked up and the rods screwed up. The nuts could not be turned much. It was let down again on the false works and the braces turned 90° on their own axes. Additional ones were put in at the end panels, making six instead of four, and the bridge then stood. The little L-shaped lugs on the angle blocks were mostly chipped

off to allow the braces to be turned, also some corners of braces, leaving them with nothing but friction to hold them in place; for what little was left of the lugs did not fit the new position of the braces. Paint marks now show them to have moved some inches out of place when last painted. The braces were all 6 in. I-beams, rolled iron, with a section of 6 to 9 square inches, the heavy ones being supposed to be at the ends of trusses. Beginning at each abutment each panel had the following number of braces leaning forward toward the other abutment, viz.: 6, 6, 7, 4, 4, 3, 3, 3, 2, 2, 2, 1, 1, 1, 0. The end panel having no counterbrace, its main braces were stayed at half length by a bolt and gas-pipe strut passing to the first bottom angle block. There was no vertical end post at the abutments. The top chords had each two of their members extending over to the back wall, where they bore on rollers at one end, making a beam 12½ ft. span, composed of two six-inch I-beams directly under one rail of the track and carrying about 86 per cent. of the loads passing over this track, for the other beam was 17 ft. 2 in. distant. The several braces of each set were connected only by a yoke of two rods of ½ in. diameter at their intersections at the centre of their length, with cast packing pieces between them. The vertical ties were 8 in. number at each angle block, 2½ in. diameter at ends, and varying to 1½ in. at middle of truss. They had forged heads at top, and were upset at bottom, where nuts were applied. Their ends bore against iron washer straps, which extended across full width of chords and on the bottom chord somewhat more at the inner end for connection of the lateral brace struts. These struts were railroad bars, confined by a stirrup passing over top of rail and down through holes in bottom flange to bolt to the strap described above. They were applied at alternate panel points 22 ft. apart. The bottom lateral bracing was in panels of 22 feet, composed of flat bars, 2½ in. × ¼ in. Their ends were hooked into recesses formed for the purpose in the cast-iron angle blocks, but they had no adjustment for length. A most unique feature in this bottom horizontal system was this, that the tie braces met at the chords at points intermediate between those where the struts were applied and 11 feet distant, so that if they had ever been screwed up the chords would have been pulled into a zig-zag or serpentine line, while in their actual condition all the lateral forces arising from the wind or from the passage of trains over the bridge, instead of being counteracted or controlled, must have been assisted by this arrangement to break up the alignment. The top chords were formed of five lines of 6 in. I-beams, side by side, two panels long and breaking joints. Their ends abutted against cast-iron lugs on the angle blocks, 6 in. high, 5 wide and 1½ in. thick, these lugs being omitted where the bar was continuous, three at one point, and two at the next. These I-beams were connected to each other only by ½ in. bolts and cast spools, two in a panel! Instead of closely fitted end bearings they were shimmed at the ends against the lugs of the angle blocks. It is said this was done to give the desired camber, the top chord being cut a little short for that purpose. These shims were held in place only by friction. The weight of these 6 in. I-beams varied, their webs being from ½ in. to 1 in. in thickness. The heavy ones were supposed to have been in the central part of the length; but, as in the case of the braces, they were so scattered and mixed by the clearing of the ground immediately after the disaster, in erecting trestles for the tracks, that little clue was left to their original position.

No broken ones were found, but they were bent and twisted in all sorts of shapes, as were also the floor beams, and all were generally completely separated by the fall. The floor beams were also 6 in. I-beams, spaced three to a panel and about 25½ ft. long. They rested directly on the top chords, which were thereby subjected to transverse strains, by the passage of every wheel on the tracks. At alternate panel points there was a lug riveted to the bottom of a floor beam, fitting against the inner edge of the top chord, thus acting as a strut for the lateral bracing. The latter was in panels of 22 feet, composed of 1½ in. round iron, flattened at ends and formed with a hook fitting a recess in the angle block, and held down by the weight of the top chord bars. There was no adjustment of length. A stirrup passed over the floor beam acting as strut, and confined it to chord. There was originally only one track on the bridge, but of late years two had been used, spaced 7.20 ft. apart in clear, so the outer rails came almost exactly over the centre of the trusses. Under these rails were two pieces of longitudinal timber, each 7 in. × 12 in., and under the inside rails three pieces of same size. Another stringer lay outside, at each edge of floor. Don't know about any in middle, between tracks. The ties covered the whole width of 25½ feet, spaced one inch apart and made of oak, 3 in. × 5 in. Besides guard timbers on edges of floor, there were guard rails inside the tracks, converging to centre of track near end of bridge. This floor was better than the average of bridge floors, and if the ties were sound, as we have every reason to suppose them to have been, they would have sustained a derailed car and perhaps an engine, at least anywhere but in the middle of the width of the bridge. There was a pair of transverse vertical braces every 22 feet, made of 1½ in. round iron, adjusted by turnbuckles. They were flattened at ends with a hook fitting a recess in the angle blocks, but were held in place only by a top bolt of ½ in. diameter screwed into the castings!

#### POSITION OF THE WRECKED TRAIN.

The train was moving westward on the left or southern track, speed stated at 12 or 15 miles an hour, during a heavy snow storm, and was composed of two engines and eleven cars. The leading engine crossed in safety. The draw-bar connecting it with the second engine was broken by a transverse strain, as if it had been bent down over the edge of the abutment on the fall of the second engine into the chasm. This engine was found bottom up on top of the express car, and within a few feet of the west abutment, on the south side of the bridge. The rest of the train was heaped up between this and the east abutment, all on the south side of the bridge except the rear car, which was thrown by some oscillatory movement quite across the road-bed and over the north side of the

abutment. A careful inspection of the wheels removed from the river shows a few broken, others cracked. They generally show marks of intense heat from the burning wreck, but give no indications whether sound or unsound before the fall. The cracked and broken ones are but few considering the fall, some 70 feet. No evidence could be found of wheels having been derailed. Some 30 to 40 ties were found unburned, but these showed no wheel marks. Both of the enginemen deny any derailment.

#### POSITION OF THE WRECK OF THE BRIDGE.

The top chords and floor beams and braces were scattered by being hauled out of the way at once after the wreck, before any inspection of their exact position. The bottom chords hung together and lay in the water, nearly under where they had been in the bridge, but had moved about eight feet north and eight feet easterly, so the south chord lay near the centre line of the bridge, and the other parallel on the north side. Both were curled up about a panel length against the east abutment. This indicates pretty clearly that the fall began toward the west end, the whole thing hinging for an instant on the easterly end, and thus drawing the chords eastward as they fell.

The first set of braces in the south truss at the west end had their top ends under the north bottom chord, and were nearly straight except where bent by the chord falling on them. This indicates that the south truss fell quite over to the north at this end before the north chord fell. The first set of vertical rods in the south truss had spread out their top ends like a fan against the west abutment. Their top angle block was jammed down to the bottom chord. The second set of rods of south truss was bent over to the south, the top angle block quite down to bottom chord. The third set of rods bent over to the north, with the top angle block nearly down. Other sets following bent north with angle block at top till near east end, where they again bent south. In the north truss all the rods were bent over to the north.

The indications all tend to show that the failure began near the west end of the south truss, either by the displacement or buckling of the main braces or top chord about two panels from the west end. This part of the floor sank, tipping the train to the south, while the reaction sent all that part of the bridge northward except at the second panel from the west end where the failure seems to have begun and was therefore not influenced by the lateral reaction of the train. The top angle blocks could not have slid down on the 8 rods which passed through them after the latter had changed their position, so that the braces must have ceased to support these blocks during the first instants of the fall. Considering the incoherent nature of the truss, and the frail attachments of its various parts, there seems to be sufficient elements of instability to account for the disaster without supposing any derailment.

BOSTON, Feb. 3, 1877.

EDWARD S. PHILBRICK, C. E.

### Ashtabula and the Engineers.

BALTIMORE, Md., Feb. 5, 1877.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the beginning there was an engineer who made a plan and was discharged. And the plan, with orders to change thence and such, fell into the hands of a master machinist who knew nothing thereof, and therefore got out the iron very right for the wrong place, but remarked that there was plenty of it. And thereupon, a foreman of carpenters, knowing still less of the iron work, and still more afraid to say so, took it and put it up at Ashtabula under "silence or quit" orders, and it was called a bridge. The top chords and braces were of single beams laid side and side but not laced so as materially to stiffen each other. The lateral struts were put where braces belonged. The lateral system was light and its attachments lighter, and ribs were chipped off angle blocks that braces might slide into place—or out of place.

The span was swung off, and after settling below a level was blocked up again, patched and "shimmed," and more loose beams put in; then swung off again and put to work carrying the passengers and trains of a great double-track trunk railway line, and all without at any time having had the presence or supervision of any man who could be called a bridge engineer; for, excepting the original plan, which was so altered as to amount to abandonment, everything about it was done by "rule of thumb" men who are satisfied if the things look strong or in accordance with some preconceived ideal. The deformed and crippled structure, child of such mixed parentage, carried its daily burden, almost on the point of breakdown, for eleven years, *mirabile dictu*, and then begat its legitimate fruit—a massacre.

My special experience extends over the design and construction of over sixty-five thousand lineal feet of iron bridging by my associates and myself, and standing on this experience I do not hesitate to say that the overworked condition of that Ashtabula span could have been detected at any time during the eleven years of its labor, by an engineer who was really an expert in iron bridges. I say an expert, as I know the vast difference that exists between an inspection by a general engineer, and that of one who has devoted himself to this as a specialty, and who knows all a foreman's tricks; has designed and put up trusses and taken them down again for alteration of his own accord; has acknowledged his failures and sometimes paid damages therefor; has studied trusses, joint by joint, under all conditions of load, and put himself in unison with their pulsations; has noted their peculiarities and watched their decadence, the same as locomotives; and has known them to give way as men do, from some defect in their constitutions.

The general engineers who devote perhaps a fifth of their time to bridge matters, do not see the difference between their own inspections or designs and those of the specialist; but the specialists do see it, and point to Ashtabula as evidence on the inspection count against the general engineers, and on the design count against the mass of conceited and bull-dozing ignorance which rendered such a man-trap possible in a country as



full of specialists as this was when the bridge was put up. Realizing these differences, I cannot see the force of Mr. Clark's recommendation of a law under which army engineer officers are to be detailed as bridge inspectors. These gentlemen are not iron bridge experts in any sense of the word, and would, with two or three exceptions, require years of special training. I have before me a letter from a Colonel of engineers rejecting one plan of truss on account of its greater depth and consequent greater liability to deflection than other plans submitted; and in addition to this choice bit of wisdom he illustrated his impermeability by refusing to notice our humble suggestion that it was the rigidity and not the flexibility of a truss that was increased by increasing the depth. The practical results achieved and the rulings promulgated by an inspection bureau "commanded" by the Colonel in question would be truly edifying if not terrific, and it is to be hoped that his example finds itself lonely in the corps.

Neither can I agree with Mr. Herschel in thinking that engineers who have gone into bridge building, i. e. contracting engineers, have changed their profession or their natures. This charge may hold good where the contracting engineer becomes also a manufacturer, and is brought face to face every day with the temptation to put into the bridge a hundred-dollar column which his men have made defectively, and which he must use or lose, but which column the contracting engineer (who don't manufacture his own work) would calmly reject, and that without any qualms for the other man's pocket, as quickly, on his own account, as though he were merely a contracting engineer and inspecting for some one else on a salary.

It is really the contracting engineer who is responsible for the great progress in design which has characterized American bridge practice. The manufacturing engineer plants down his machinery and then conforms his practice and opinions to its products. A change in detail calls for new machinery: therefore he is conservative. The constructing engineer, with no dollars at stake, prefers the venerable plan of riveted joints and surplus metal in the body of his tension members, double "tees" in his posts, and an unbalanced, three-sided, open-trough top chord, to which he tacks on his diagonals with rivets, and makes up for the ambiguity of the strains therefrom by a super-abundance of formulae and much wisdom of demeanor. The contracting engineer, who stakes his dollars on his estimates, and has to make his profits on top of the manufacturers' prices (and they are higher to him because of his more rigid inspection), looks to perfection in design of proportion and detail to show him a margin. He gathers the rivets into pins, and reduces the body of the tension bars to actual requirements by swelling the ends of them into eyes or loops. He boxes up the fourth side of the trough and thereby increases its strength per square inch at least one-third, and uses these columns for both posts and top chords, saving thus perhaps one-fourth the iron required. Instead of letting the strains run loose along the edges or corners of these columns, he puts in short, thick, long-tenoned blocks of best cast-iron to distribute the strains equally over the whole column section, and thus at once avoids the ambiguity of strain, the formulae, and the demeanor, and his bridge is built of large pieces, instead of scraps and sheet iron. Is the contracting engineer really leaving the profession, as Mr. Herschel intimates, or is the pace too fast for the others?

FRED H. SMITH.

#### Mr. Herschel on the Ashtabula Bridge.

TO THE EDITOR OF THE RAILROAD GAZETTE.

If the public is not by this time well posted on the subject of iron bridges, it is not for the want of popular instruction. Ever since the Ashtabula horror, the press has been filled with discussions, wise and otherwise, and no end of measures have been suggested for preventing the recurrence of such a calamity. The parties to these discussions may be grouped in three classes. First, we have a class of writers anxious that the public should realize that iron bridges are not necessarily unsafe, but that they must be intelligently designed, supervised and executed by experts, familiar not only with what the books say, but with what the shop, foundry and rolling mill teach. A second class, embracing the occasion for notoriety that popular interest in a great disaster always presents, rush into print, anxious to propound new theories of iron, spread themselves upon molecular displacement under variations of temperature, and illustrate by broken wheels and axles the crystallization that iron undergoes in bridges, which must necessarily result in failure after a term of years. These critics see no safety in any material but wood as a constructive medium for our bridges, and would have the profession return to the practice of the "fathers." The daily papers are filled with stuff of this kind, an example of which may be found in a recent *Evening Post* editorial, wherein the editor sublimely concludes that "if iron in the form of rails wears out, then iron in the form of bridges wears out."

The third class, with an eye to business, recognizes the transient popular interest in iron bridges as an opportunity too good to be lost for some cheap advertising, and embrace it quickly before it fades into some other nine-days' wonder. Knowing full well that almost everything headed "Ashtabula" will at this time be absorbingly read, they give popular scientific essays on iron bridge building, never forgetting to weave into their essays large personality, and lead up to a peroration embodying an infallible remedy for utterly preventing the construction of dangerous bridges.

Mr. Herschel's extraordinary letter to the *Boston Daily Advertiser* (reprinted in last week's *Gazette*), purports to be an answer to sundry questions propounded by *Harper's Weekly*, and while apparently a sincere contribution to popular information, divested of all verbiage its anathema attack upon well-tried and approved forms of bridge construction, with a laudation of riveted work, to which the writer is especially devoted. Can the spirit of un-

fairness and special pleading go farther than to select the Ashtabula bridge as an example of a system of construction "which latterly has been claimed with pride as peculiarly American?" Such an assertion I would never have attributed to Mr. Herschel had I not seen it over his own signature; but since he sees fit to make that statement I can only regret that his studies have led him to such a grotesque illustration of the "so-called American" system of construction.

Since Mr. Herschel objects to the distinctive appellations of "American" and "European," as descriptive of two distinct forms of construction, I have no objection for the time being to adopt his nomenclature of "budded and riveted" bridges as I follow through his special pleading. To illustrate the danger of the former method of construction, the recorded failure of perhaps a half-dozen bridges is given, to which, by the way, I could add as many more. The fact that there have been no published failures of riveted work, in this country at least, I am willing to admit without question. But the ingenious antithesis proves nothing, except to the audience to whom the letter was addressed, "the people." To them such evidence would naturally be conclusive, difficult to overturn by any argument based on scientific facts and principles. One thing is unquestionably true, and that is, that "budded" bridges, unless properly designed and thoroughly well built, are unsafe, much more so I believe than a bad piece of riveted work. The comparison of two systems of construction, however, whether in bridge building or in other matters, should not be made between the worst of one kind and the best of another, or between bad examples of each, but it should be made between the best development of each kind. Mr. Herschel's method of argument would lead a man to condemn brick walls because he noticed that such walls occasionally fall down, without regard to the fact that they were too thin or badly built. The illustration given of bridges on the Central & Hudson, and the Boston & Albany railroads, as being in all things what a bridge ought to be, are not to the point, since we all happen to know the history of the introduction of lattice bridges on those roads. Had it not been for Howard Carroll, a brilliant Irish engineer, a pupil, I believe, of Sir John McNeill, and an engineer on the New York Central Railroad a short time prior to the war, I doubt very much whether there would have been a riveted bridge on that road. Mr. Carroll, fresh from English practice, at a time when Americans, barring Mr. Whipple, literally knew nothing of iron bridges, built up a "riveted" school, as it were, and left bright and clever scholars to perpetuate his teaching. I simply mention this historical fact to show that riveted lattice bridges on the New York Central Railroad were not adopted for that road as the best method of bridge building after a scientific comparison with other systems, but were simply the result of accident.

I hope and trust they will last as long as the roads exist, but as for asking the great majority of American bridge-builders to give up the results obtained by the magnificent successes of the past ten years, is simply preposterous. It is notorious that the "budded bridge" was a revelation to the foreign engineers who came to this country last year to study our constructions, and I have yet to hear of one who returned home not a convert from European methods of construction. Mr. Herschel may as well make up his mind now as any other time, that until the law of progress is reversed, crab fashion, our great bridge building firms will keep on developing the "budded bridge," a system truly American, and one that can be pointed to with becoming pride; and I sincerely trust that a less partisan study of the subject in the shop and field will find him at the end among the converted.

As to the advice freely given at the close of this remarkable letter, that the separation of the designer of the bridge from the contractor should be complete, and that railroad companies should employ a constructing engineer to prepare the designs for their bridges, and have the same relation to the manufacturer as obtains in England and on the Continent, it seems at first plausible. Such a system of procedure, however, would stop all progress, and had it been in vogue in this country, we should long since have gotten into a rut of precedent, just as the engineers on the other side of the water have done. Mr. Herschel would have bridge-builders not engineers and contractors, but simply contractors, carrying out with Chinese fidelity the designs of the constructing engineer. He would not have competitive designs, but only competitive prices. Competition is the very life of development, and it is that principle which has developed new machines, methods and appliances in bridge building that I feel very confident, would never have been dreamed of had the contractor been simply a manufacturer, with no control over the design. Iron bridge-building, at least, on the "budded" system, is not alone a matter of strain sheet, but largely and principally a matter of the rolling mill, forge and machine shop; and it stands to reason that those who have made a life study of such matters are much better calculated to adopt means to ends, than the constructing engineer, who, with a miscellaneous practice in engineering works, has neither the time nor opportunity to study the details of shop manipulation, be he ever so brilliant and clever. Division of labor is an inexorable law of modern times, and among its divisions in the line of technique, is that of the "engineer, contractor and bridge-builder," whose business it is to keep thoroughly well informed in all matters bearing on his art, and strive in business rivalry with his competitors to make continual improvements in design and economies of manufacture. There is plenty for the constructing engineer to do, in preparing general limiting specifications as to the requirements of any particular case, and in the inspection of work, but he should not prevent the bridge-builder from taking advantage of his knowledge, gained by devotion to a specialty.

At another time I may take occasion to state what I believe to be the best method for railway companies to adopt when they want to build a bridge, so that they may take advantage

of experience and at the same time remove the possibility of accident to a remote contingency. ALF. P. BOLLER.  
NEW YORK, February, 1877.

#### Butt-Joints, not Pin-Joints, Condemned.

BOSTON, Feb. 3, 1877.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I think your editorial of Feb. 2 does my opinions alike too much and too little justice or credit. I do not object to the *pin-joint*, especially not in diagonals. But *pin-joint* is not the proper name for the article. Under cover of that name we are told to swallow plain butted, or cast-iron joint-box compression joints, the use of bolts and nuts that are for ever rattling loose, where rivets are evidently better, cross-members laid on, when they should be firmly riveted to, the main trusses, and much more of an unwholesome character.

Let us call things by their right names and then judge them according to the evidence. CLEMENS HERSCHEL.

[We had no intention of commenting on anyone's opinions on different kinds of structures, further than to point out that there are differences of opinion among the most conscientious and best-informed specialists, which we attempted to illustrate by reference to Mr. Herschel's letter to the *Boston Advertiser*, in which we understood him to condemn for railroad purposes a type of structure which some other respectable engineers prefer. Not having in mind to pass any opinion on that or any other structure, we were not careful in naming it. For our purpose at the time, it did not matter whether or no he would be right in condemning it.—EDITOR RAILROAD GAZETTE.]

#### Train Dispatching and the Quincy Accident.

QUINCY, Ill., Feb. 5, 1877.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your number of Feb. 2, "H. C." makes a few comments upon a previous article entitled "Train Dispatching," but does not give any light upon the principal subject at issue, viz.: the keeping of the system of telegraphic train orders as separate as possible from the time card. He says the writer "gave an 'eccentric' impression of train dispatching." That may be true, but in any event it was a truthful account.

He also says: "The order simply gave him (the conductor) the right to run, working his way against or keeping out of the way of all regular trains." There was the trouble, for, by the addition of the words "after the arrival of C. B. & Q. No. 101" the loss of two lives and thousands of dollars of property would have been avoided. On the other hand, if the time card alone had been relied upon, the disaster could not have happened.

This proves that train-men are right in claiming "that the fewer telegraphic orders they get and the more the time card is relied upon the safer they are."

It is the unnecessary combination of telegraph orders and time card that does the mischief. E. C. CENTRIC.

#### "The Location of the Cincinnati Southern Railway."

TO THE EDITOR OF THE RAILROAD GAZETTE:

To locate a railroad line well upon paper is one thing, and to locate it well on the ground is quite another, both requiring something of skill in order to meet the requirements of a good location. There probably never yet was a location made either in the field or in the office to which objection could not be taken, and it is more than probable that more objections can be made in the office, whether valid or not, than would be made by experts who might examine a line in the field.

It is easy to suggest a probably desirable location at points where heavy work has been encountered on an adopted line of railway by any one having a map of the country before him and the elevations of the highest and lowest points crossed by the adopted line, especially so when the would-be critic has "personal knowledge of what would ordinarily be the heaviest portion of the line," and it amounts almost to a conviction that the "indications cannot prove deceptive," but that a better, cheaper, shorter and straighter line must lie just within sight of the adopted line.

The further conviction is forced upon our minds that to determine the alignment of any proposed line we have only to seek for two points as remote from each other as possible, having as nearly as possible the same elevations, which may be determined by a pocket barometer; build your line between these points with  $\pm 20$  feet grades, at a cost of \$3,000 per mile; use any necessary gradient for the remaining portion, being careful not to exceed gradients  $\pm 90^\circ$  per mile, and no doubt you will have the shortest, cheapest and best road on the continent, lying almost within sight of any adopted line.

This reminds me, a writer on the Improvement of the Alignment of Railways, of a survey made out West to secure a land grant, the map and profile of which went before Congress, which pronounced it short, straight and cheap, easy to build and light to run, with a remarkably uniform gradient, and moreover fulfilling your first condition fully in regard to having as light gradients as possible for the longest distance possible, so that it seemed to favor both schools, the uniform gradient advocates and the light grades for long distances supporters. There seemed to be nothing to be desired to make this the best line on the continent, when one day it came out, through some indiscreet, leaky projector, that the line ran for its whole length in the bed of some majestic river, which had very considerably gone dry for the sake of the railroad.

They do strange things "out West," Mr. Editor, they say, but not more strange he "down East" would have us do who wrote the article on the location of the Cincinnati Southern Railway, as we now propose to show.

One may very reasonably question the "personal knowledge" of a country which any one has, much more the personal knowledge of him who proposes to instruct in the location and



construction of railways, who should even hint, although he "hesitates to say," that there was a possibility of building a shorter and cheaper line than the adopted line of the Cincinnati Southern by starting at the summit between Emory River and the South Fork of the Cumberland, descending thence into the valley (?) of the South Fork as quickly as possible, and follow its sinuosities to the Cumberland; but when it is further mentioned it would be probably straighter than the adopted line, one feels like stopping to inquire whether Mr. Wellington may not have had something to do with that paragraph in the "Gilded Age" wherein it is stated that you cannot tell whether or not a town lies between two points on a straight line until the engineers come round.

There are very good reasons for not making a survey up the South Fork of the Cumberland, and when they have been stated it will not seem so strange that no mention was made of this stream in the report, as affording a suitable approach to the summit between its head waters and those of Emory River. The connection, or the point I wish to illustrate by reference to the survey "out West," will be also apparent in this proposed location in the valley of the South Fork, when it is mentioned that the elevation of high water is seventy-two feet (72) above low water; that the South Fork has been known to rise forty feet in twelve hours; and since the drainage of the South Fork is not very extensive, there must be a further reason for these high floods, which is, that what water does not come into the stream is confined to the narrowest possible limits, being much of the way forced through narrow gorges or canons, the walls of which rise up nearly vertical or entirely so, from a height of one hundred to many hundred feet high; and that instead of its course being the beautifully straight way so earnestly desired and expected, the trail of a serpent was never half so devious. This accounts for the high floods. The nature of the watercourse exercising so great a "detering influence" on the flow of water, it seems hardly necessary to say that seeking for a short, cheap and straight railroad line between its cliffs is far more a chimerical chimera than building on the "divide" with uniform gradients.

From my knowledge of the country, derived from several months' acquaintance of it, I do not hesitate to say that the cost of constructing, operating and maintaining this proposed line would as much exceed the cost of the same on the adopted line as Mr. Wellington thinks the cost of constructing, operating and maintaining the adopted line would exceed that of the proposed line, and to use his own words very nearly, it does not matter how much that may be.

Instead of having, as on the adopted line, 6° maximum curves and only a few of those, these in the valley would be minimum curves; the maximum would be 20°. On such an alignment no one doubts the desirability of using the "central-rail system." There would be tunnels, iron viaducts and trestles without number; many high embankments and much expensive masonry; all of which would be subject to almost certain destruction, in a night, from violent and frequent floods, except perhaps the tunnels.

It would be unjust not to say that the writer on the location of the Cincinnati Southern expresses many and grave doubts in regard to the desirability of this proposed location; nevertheless he adroitly draws conclusions from the unsound premises as though they were sound, and hence concludes that building a line of uniform gradients is a costly chimera.

Now I may and I may not be an advocate of the uniform gradient system; therefore I shall have nothing to say in regard to that portion of the article. I will stop to remark, however, that as a rule engineers are not satisfied with "probabilities" or "indications." There is an office in Washington whose peculiar province it is to set these things forth; we will be content with nothing short of possibilities, and to that portion of the article we now turn; namely, the cost of constructing a railroad in Sequatchie valley.

For the purpose of comparison, I will take the lightest division (H) on the line of the Cincinnati Southern Railway. I shall assume, of course, that the same character of work is to be done in Sequatchie Valley that has been done in the Tennessee valley, and further, which will be more than fair, that the cost of graduation in Sequatchie with 20 feet grades will be the same as that in the Tennessee valley with 40 feet grades.

It cannot be said that there has been any extravagant or wasteful appropriation of money on Division H. It has been built for permanence and utility. Neither can it be assumed that waterways would be less numerous or less expensive in Sequatchie Valley than in that of the Tennessee; for while in the Tennessee valley we have to provide waterways for the drainage from Walden's Ridge on one side or from some smaller knobs and ridges on the other side of the line, the greater portion coming from Walden's Ridge. In Sequatchie valley you would have to provide waterways for the drainage from Walden's Ridge, or that from the Cumberland Mountain.

It was also thought that a few box culverts and girder bridges for larger lateral streams would suffice in the Tennessee valley until the spring of 1875, when the "head water" from the mountain covered a considerable portion of the country. The surveys having been made at a dry season of the year, adequate knowledge could not be had until after the floods had been seen at their highest, in 1875.

The cost of this lightest division is about \$14,000 per mile, distributed as follows:

General graduation.....	\$8,000
Masonry and foundations.....	5,000
Girder bridges (Howe trusses).....	1,000
	\$14,000

which does not include engineering expenses, expenses for right of way, borrow pits, and the like, which may be put at \$1,000 per mile, making the cost of a mile of road completed to subgrade equal to fifteen thousand dollars.

This would be approximately, nay very nearly, the cost of the average mile in Sequatchie valley, from which it appears that the cost of the masonry alone would be sixty-six and two-thirds per cent. greater than the assumed cost of an entire average

mile, whilst the cost of the average mile would be 500 per cent. greater than Mr. Wellington's estimate; whilst on the 46 miles under consideration there would need to be added in addition to his estimate the very considerable sum \$552,000 to complete the road.

We here leave the author "On the Justifiable Expenditures for Improvement in the Alignment of Railways" at Pikeville to make the ascent to the plateau of the Cumberland as best he may, while we pause briefly to inquire whether or not there may be here needed an additional appropriation of \$12,000 per mile, and if after all he may not be pursuing a very delusive chimera.

JAMES D. BURR.

CINCINNATI SOUTHERN RAILWAY, JAN. 29, 1877.

### The Extent and Object of Railway Accounts.

[From a forthcoming work entitled "Railway Revenue and How to Collect it," by a railroad accountant.]

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The most economical system of accounts that can possibly be devised is the best, provided it enforces proper responsibility and secures just and prompt returns for moneys collected. The problem that appeals to every railway officer in any manner responsible for the accounts is, how to reduce the details to the minimum consistent with efficiency and increase the skill of the laborer to the maximum.

Certain simple and fundamental accounts are required from agents and others from which to compile the receipts and disbursements of the road at the general accounting offices of the company.

A nice discrimination is required to be exercised between those checks or safeguards that are at once simple and efficacious and plainly necessary, and those that require elaborate and expensive machinery, or are, in the end, dependent for their efficiency upon the honesty of the very officials it is desired to check.

In illustration of this idea, the elaborate machinery in force upon certain roads for the purpose of ascertaining if the tickets returned by a conductor harmonize with the tickets sold for such conductor's train has cost many hundreds of thousands of dollars for blanks, books, and men to manipulate them, and is in the end comparatively valueless as a check, for the reason that it is in the main based on the assumption that certain officials over whom the supervision is sought to be extended will do certain things or refrain from doing certain things.

It does not require a multitude of useless blanks, books and reports, with the horde of attendant clerks, to detect the presence of dishonest practices.

The clue is obtainable in other and simpler ways, some of which are suggested elsewhere herein; and once found, the delicate and subtle machinery employed by men skilled in the detection of crime affords a sure, swift and economical means of shattering any league between employees formed for objectionable purposes.

A well-selected and carefully-drilled force, understanding thoroughly the crafty and insidious appliances of the science of detection of crime, can and will unravel the mysteries of the most carefully-formed combination, and utterly destroy the men engaged in it.

It is not desired to criticise herein any established plan or system of accounts, and the particular method of checking tickets just referred to is cited here in a friendly way, as a "frightful example"—the dead fruits that sometimes follow too attenuated thought, too much elaboration of accounts, on roads otherwise managed with great wisdom and economy.

However, but few of our companies can be accused of too much elaboration. "Whatever is, is right," may be said to be the governing rule in reference to accounts on the great bulk of our roads. This arises from the fact that a large number of those in charge of the accounts are selected hap-hazard, or simply because they are good-natured, inoffensive people. This last-mentioned class are much sought after for positions of trust by managers impatient of any restraint or governed by motives still more objectionable.

Such men, besides being timid and pliable, also lack energy and administrative ability.

The active, aggressive young men of this country rarely, from choice, become accountants. No entrancing glamour surrounds the place, no indefinite possibilities are associated with it. The office is without honor or emoluments; an energetic and effective discharge of its duties entails myriads of enemies, few supporters and no friends; such a course not unfrequently invites persecution, misrepresentation and every species of harassment that the arrogance of power can suggest.

The accounting officer is the auditor of the local manager. The position, therefore, needs all the strengthening it can get. It should in fact be directly subordinate to those high executive officers who represent the directors and stockholders. The subordination of the accounting officer to the Superintendent is not contemplated or permitted upon any well organized road in this country or any other. These facts are well understood by the veteran and conservative men who really represent the owners of our railway lines.

It may be accepted as true, generally, that any organization or system, involving complicated affairs and large amounts of money, that presupposes the honesty of officials and agents, or that does not make the concurrence of at least two independent and co-ordinate officers necessary to the consummation of any important trust, is incomplete and untrustworthy; and speculation, with its thousand collateral abuses, constantly menaces a company whose affairs are so unfortunately organized.

Accounts intended to record the affairs of business conducted upon an extended scale and to provide an adequate check against fraud must, if effective, be organized and conducted, generally, upon the theory that every man may become dishonest. A comprehensive system of this character steadies and encourages the well disposed and prevents the weak from succumbing to temptation.

Under these circumstances, no trustworthy and honorable man will object to any necessary or proper check, but will, on the contrary, cheerfully invite such surveillance as may be needed to compel a faithful discharge of duty from all.

To make the check adequate, however, with large corporations, involves in its broadest sense what the ignorant, the shallow and the vicious term, in common, "red tape."

Every officer, or person representing an officer, should not only serve the company personally in good faith, but should at all times labor sturdily and zealously to prevent the introduction of any questionable customs or precedents, sought to be introduced through ignorance or design, that may be distorted or made use of by dishonest men, to the detriment of the company he represents.

So far as the rude framework of railway accounts is concerned, no one can, of course, claim to have originated it. It has existed, practically, since the first road was opened. It is in reference to the manner of execution, and in the niceties of detail, that this book treats; and in this connection the writer desires to acknowledge the valuable aid and information afforded by those immediately connected with him, for which it is impossible to give more explicit credit.

In reference to the forms appended, many of them originated with the writer; where and when the others were first introduced, or by whom they were introduced, is unknown to him: none of the blanks possess any especial merit except that they are simple and inexpensive.

Whether the plan of accounting sketched herein is absolutely the best and the cheapest that can be devised, it is not necessary here to discuss: whatever the system may be, as already explained, it does not affect materially either the subjects discussed herein or the manner of treating them. With a few technical exceptions, the rules governing one system of accounts are applicable to all, the general principles remaining the same and the inherent weaknesses of each, as a system, not being noticeably different.

If the success of a system demonstrates its value, then the system as shadowed forth herein may be said to answer, substantially, that test. Many of the rules and regulations here laid down have long been in practical operation, having been introduced by the writer, from time to time, as the necessities of the service required; and during the last eight or nine years he has, with their aid, as already explained, been able to collect in the neighborhood of one hundred and fifty millions of dollars through the hands of a large number of constantly changing agents, without the loss of a single dollar from defalcations.

In the accomplishment of this result, much has been due to the efficiency and skill of the traveling auditors in executing his orders; hence, in the preparation of these instructions, the writer fell naturally enough into the habit of addressing his directions to them, as if he and they were acting together in their official capacity. He has elsewhere written as if referring to some particular company. This plan has the merit of directness and simplicity, perhaps, but possesses other defects for which the writer craves indulgence.

In these instructions to traveling auditors, the vicious element in railway life assumes a prominence that is not pleasant and that is apt to mislead those who are not personally familiar with the responsible character of railway agents. THE BAD ELEMENT COMPRISES BUT AN INFINITESIMAL FRAGMENT OF THE GREAT WHOLE; but to guard against the depredations of the few, the many are unavoidably subjected to what would otherwise be harsh and unjust rules.

Our railway officials and agents and operatives are as trustworthy a body of men as can be found anywhere. They are, as a class, honest, industrious and faithful men; men of great discretion and native sagacity, who in their several ways watch over the interests of their employers, and the safety and convenience of the public, with unvarying patience and assiduity.

### January Meeting of the Master Car Builders' Association.

The meeting for January was held at the rooms on Liberty street, New York, on the evening of the 18th. The President called the meeting to order, and announced as the subject for discussion the "Application of Power Brakes to Freight Trains." He quoted the opinion of a friend that continuous brakes were needed for freight trains, but that thus far no one has devised a brake that is efficient, simple and cheap enough.

Mr. LOUGHMEADE was called upon and said he had no doubt of the feasibility both as to work and economy in the adoption of a power brake for all kinds of trains. The Baltimore & Ohio Railroad is running some two or three freight trains with the engine brake and is ready to have it on all the freight cars, and is, he believed, equipping for that purpose. The cost of maintaining his brake on the engine will probably be \$5 per year. He knew of one which ran a year and a half for \$1.50. It will cost from \$5 to \$8 per year to keep up the pump. He furnishes a pump at \$75, and an eccentric must be added. The Baltimore & Ohio Railroad manufactures the whole thing at its shops. It costs that company about \$40 per car for freight cars. It puts on double brakes. With all the elements necessary it costs the company \$170 for the engine appliances. The Baltimore & Ohio Company use a pump which is 7½ inches diameter and 7 inches long and open at the end, no head on it, but simply a piston worked by an eccentric on the axle. The cylinders for the cars, he thought, would cost \$15. He thought his train brake could be put on at from \$35 to \$40 per car, and \$200 per engine, including coupler, hose and everything.

Mr. GAREY said he thought inventors made a mistake in looking for too big a royalty. The immense number of cars to which such brakes could be applied will warrant the royalty to be put at a very low figure.

Mr. WELCH, of the Westinghouse Brake Company, was called on and said that at the Master Car-Builders' annual convention a resolution was passed, he thought, looking to the adoption of a cheap continuous brake for freight-car service. The company with which he was connected, after receiving the circulars issued by the Association, devised plans and issued printed illustrations and a description showing the application of such brakes to freight cars having a hand brake on one or both trucks. The plan is simple, and there is only one cylinder and a single line of pipe to each car and a single hose and coupling. The single freight brake is offered at \$50 and the double one at \$60 per car. The terms on which these brakes are offered to railroad companies are such that the saving effected by its use will be sufficient to meet the payments as they become due, or,



in other words, the brake will earn the money to pay for itself.

Mr. E. W. EAMES, the inventor of the brake known by his name, stated that a vacuum brake would fulfill all the requirements of a freight-train brake, whether the train consisted of one car or one hundred. It requires no large reservoir to hold a sufficient amount of compressed air. He would put his brake on cars at \$20 per car and \$100 per engine, or would give railroads the right to use it at \$4 per car and \$8 per engine. He was ready to put it on 75 freight cars and submit it to a trial by experts.

Mr. LOUGHRIDGE said that Mr. Eames' offer was more liberal than either his own or that of the Westinghouse Company, but the question he thought was in regard to the value of a brake: is it constantly uniform in its action? You must always be provided with a power that is adequate to the emergency. A brake that will use all the retarding elements that are inherent in the train. It is not the brake that stops the train at all, it is the means of stopping the train, just as the locomotive cylinders attached to the driving wheels are the means of pulling the train. A train could be stopped by running a pole between the driving-wheel spokes and it will slide your wheels. The question of a saving of \$10 or \$50 to a car is not worth a particle of consideration if after you have saved that amount you are not able to stop your train promptly.

Mr. EAMES: It is not the brake which makes the quickest stops that is wanted, it is a brake that can be depended on; that is ready for operation at any time, wet or dry, hot or cold, under any circumstances, and that is where he claimed his brake excels. He submitted a printed report of trials made with his brake on the Oroya Railroad in Peru, South America.

Mr. CREAMER suggested that the inventors and others representing different forms of brakes should illustrate their construction on the blackboard and describe their operation.

Mr. EAMES therefore made a sketch of his brake and described its construction, but neither could be made clear without engravings.

Mr. PARTRIDGE: Since the first public trial of brakes on the Eastern Railroad some years ago, every trial has been made with a view to testing the shortness of the stop and the quickness of the application of the power, and yet I apprehend that a brake which does not cost a great deal for repairs, which is exceedingly simple, so that it does its work year after year without breaking down, is of more value, even though it does not stop a train quite as quickly as some others, than the more efficient brake which is the more complicated. I have ridden a good deal over roads having power brakes of various kinds since the Eastern Railroad trial. On some roads I found brakes frequently out of order. I found that it took a good deal of care to keep them up. The locomotive connections sometimes give out. Now the uncertainty of having a brake that sometimes "goes back on you" is perhaps more dangerous and will cause more expense than would be caused by using a brake which did not make quite as good stops, but which made them every day in the year.

Mr. C. A. SMITH asked Mr. Eames how long it will take to apply the vacuum to the last car. In a train of 40 or 60 cars, for example, what is going to be the effect in the rear cars?

Mr. EAMES: In regard to that I can only speak theoretically, as I have never tried it. I can make just as perfect a vacuum to a hundred cars as to one, if the couplings are tight. The difference of making a stop between a short train and a long one will be inappreciable. It is simply a question of how long it takes the air to travel the length of the train.

Mr. SMITH inquired of Mr. Loughridge whether his brake worked as effectually on the back cars as on the front.

Mr. LOUGHRIDGE: It took effect quicker on the front cars, as I found by putting an indicator in the pipe. It will take just ten times as long to brake ten cars as it will to brake one.

Mr. GAREY asked Mr. Eames what would be the weight per car of his brake.

Mr. EAMES: Probably 85 to 130 pounds.

Mr. CREAMER suggested that the tendency of train brakes and other precautionary appliances will be to diminish the amount of caution necessary on the part of the train men. He proposed the adoption of his safety brake to freight cars, operated by a bell cord.

Mr. ADAMS remarked that on roads like the Boston & Albany and the Baltimore & Ohio, where there are heavy grades to ascend, the freight trains are of varying lengths in going up a grade and in coming down. In going up the train is drawn out to its extreme length, but as soon as you get over the grade you close up very rapidly, and a train of 40 cars will close up 25 feet. Now if you want to put the brake on you must pull up that length of bell rope.

Mr. FORNEY asked Mr. Welch whether there was any other reason than that of cost for applying the old form of the Westinghouse brake to freight trains instead of the automatic brake.

Mr. WELCH: The cost is the only reason.

Mr. FORNEY: While Mr. CREAMER was talking of his brake I was struck with the similarity of the principles of his brake and that of the automatic brake as applied by Mr. Westinghouse. Now to illustrate this, suppose that the ordinary hand brakes are applied to a train by one brakeman. He will apply the brakes to the first car then he goes to the next, and so on to the end of the train. Now the old form of the Westinghouse, and also all vacuum brakes, are applied in a similar way. That is, the brakes are first partly applied to the first car, then to the second, and so on in successive steps. With these brakes they are applied much quicker than with hand brakes, but the manner in which they are applied is the same. Mr. CREAMER, however, has put his springs on each car; that is, he has put the power of applying the brakes on each car, just as though you would put a brakeman on each one. The means he uses for applying his brake is a bell cord by which he releases each spring on the cars. In the Westinghouse automatic brake, instead of using a steel spring as Mr. CREAMER does, Mr. Westinghouse uses a spring of compressed air, which is a much more elastic substance than steel, and instead of using a bell cord to release the springs, a tube is employed into which a stream of compressed air is admitted, which opens a valve under each car, and thus releases and applies the spring of compressed air. The method used with the Westinghouse brake acts much more promptly than the bell cord, and is therefore preferable.

The point which I wish to make clear is, that the principle employed by Mr. CREAMER in his brake, and by Mr. Westinghouse in the automatic brake, is the proper one, and that if power brakes are to be applied to freight cars it will ultimately result in that principle being adopted on them as well as on passenger cars. It seems very doubtful whether any methods by which you are obliged to transmit the whole power from one end of a long train to the other will be effective on such trains. Any person who will calculate the cost of hauling long freight trains and compare it with the cost of hauling short ones must see that it is inevitable that the size of freight trains will be increased. The economy of long trains is so great that it is certain that they will be used, and a freight train brake to be efficient must be adapted to such trains.

Mr. ADAMS: Is that a demonstrated fact, that long trains are more economical than short ones?

Mr. FORNEY: It cannot be said to be so in absolutely all cases, but it will at once be seen that by the use of long trains instead of short ones a great saving will be effected in the expenses of locomotive runners, firemen, conductors and brakemen. As we are on this subject now, I will mention what was stated by Mr. Howard Fry at the last annual convention of the Master Mechanics' Association. He said that on the road with which he was connected, the Philadelphia & Erie, they had been in the habit of hauling comparatively short trains, that is

of 30 to 40 cars. It then occurred to them that they might take 50, but it was said that with such trains the couplings would be pulled out and all sorts of things would happen; but after the trial it was soon decided to increase to 60 cars, and then to 75, and finally with the large consolidation engines they took trains of 90 cars with much more economy than with small trains. Anyone who will calculate all the expenses that go with a train will see the saving in hauling long trains.

Mr. ADAMS: Suppose you had the vacuum or Westinghouse brake, and you should by some mishap throw out three or four of the cars, what good would the brake do?

Mr. FORNEY: I am not considering the way in which the brakes are to be applied, but only the general principles which should be observed in any method of applying freight train brakes. Whether the connections can best be made by a pipe or bell-cord or electricity I am not prepared to say.

After a little further promiscuous discussion the meeting adjourned. The next meeting will be held on Thursday evening, Feb. 15, when the subject for discussion will be "The Relative Cost of Service of Chilled Cast-iron and Steel-tired Car Wheels, and the Best Method of Keeping an Account of the Mileage of Wheels." Railroad officers are invited to send to the Secretary the blank forms for keeping wheel accounts used by their companies. The address is C. A. Smith, No. 113 Liberty street, New York.

#### Transportation in Congress.

In the Senate, Jan. 31:

The consideration of the amendment of the Pacific railroad acts was resumed.

Mr. THURMAN explained his remarks of the day before and argued in favor of requiring the companies to pay sums in addition to those now required by law sufficient to make the whole 25 per cent. of their net earnings.

Mr. WEST opposed this bill and favored the one reported by the Railroad Committee.

Mr. BOGGS "favored the passage of any bill requiring the roads to do justice."

Mr. SHERMAN favored the bill of the Judiciary Committee—the one favored by Mr. THURMAN.

In the House, Jan. 31:

Mr. GARFIELD, of the Ashland district, Ohio, introduced a bill providing for the more thorough investigation of railroad accidents. Referred to the Committee on Railroads.

Mr. THOMAS, of Maryland, from the Committee on Pacific Railroads, reported back the Senate bill extending for five years the time for completing the Oregon Central Railroad. Referred.

In the Senate, on the 6th:

Mr. WINDOM, of Minnesota, from the Committee on Appropriations, reported adversely on the House bill to provide for the payment of James B. Eads for the construction of jetties at the South Pass of the Mississippi River, and it was placed on the calendar with the adverse report. It authorizes the Secretary of the Treasury to pay out of any appropriated money in the Treasury \$500,000 to said Eads whenever the Secretary of War shall determine that that amount is due Mr. Eads by the terms of his contract. The committee held that, by the neglect of Congress to appropriate the money until after it became due, Mr. Eads was entitled to 5 per cent. bonds in accordance with the terms of his contract with the Government. The bonds are now worth about 110, so that the contractors of course prefer them to cash.

Consideration was resumed of the Pacific railroads sinking fund bill. Mr. HITCHCOCK, of Nebraska, opposed the bill reported by the Judiciary Committee. Mr. BOUTWELL believed its provision to exceed the authority of Congress, really violating the original contract, which the railroad company has kept. Mr. CONKLING thought it improper to legislate on the subject until there has been a decision in the case now before the Supreme Court: as to what is meant by the "net earnings" of which the companies are required to pay 5 per cent. yearly into the Treasury. No vote was had.

#### TRAFFIC AND EARNINGS.

##### East-Bound Rates from Missouri River Points.

The Southwestern Railroad Rate Association announces the following rates on east-bound business from points on the Missouri River:

To—	Fourth class, Flour, per 100 lbs. per barrel.	Wheat.	Corn.
Chicago.....	30 cents.	60 cents.	30 cents.
St. Louis.....	25 "	50 "	25 "
East St. Louis, on freight to—			
Boston.....	23 "	48 "	24 "
New York.....	23 "	48 "	24 "
Philadelphia.....	23 1/2 "	48 "	24 "
Baltimore.....	24 "	52 "	26 "

These rates took effect Jan. 29.

##### Coal Movement.

Coal tonnages for the week ending Jan. 27 are reported as follows:

	1877.	1876.	Inc. or Dec.	P. c.
Anthracite.....	245,215	325,537	Dec.	80,322 24.7
Semi-bituminous.....	37,281	.....	.....	.....
Bituminous, Barclay.....	8,298	.....	.....	.....

The coal business of the Delaware, Lackawanna & Western road in detail for the year ending Dec. 31 was as follows:

	1876.	1875.	Decrease.	P. c.
Shipped north, tons.....	785,943	1,181,069	395,126	33.5
Shipped south.....	1,514,557	2,146,108	631,551	29.4
Total.....	2,300,500	3,327,177	1,026,677	30.9

The coal tonnage of the Belvidere Division, Pennsylvania Railroad, for the month ending Feb. 3 was as follows:

	1877.	1876.	Inc. or Dec.	P. c.
Coal Port for shipment.....	.....	4,613	Dec.	4,613
South Amboy for shipment.....	26,448	77,003	Dec.	50,555 65.7
Local distribution on New Jersey lines.....	17,177	12,556	Inc.	4,621 37.7
Company's use on N. J. lines.....	8,212	5,220	Inc.	2,992 57.5
Total.....	51,837	90,392	Dec.	47,555 47.9

Of the total this year 31,603 tons were from the Lehigh and 20,234 tons from the Wyoming Region.

##### Grain Movement.

Baltimore grain receipts for January were as follows:

	1877.	1876.	Inc. or Dec.	P. c.
Flour, barrels.....	88,232	100,055	Dec.	11,823 11.8
Wheat, bushels.....	146,398	118,419	Inc.	27,979 23.6
Corn.....	2,060,037	2,467,734	Dec.	407,697 16.5
Other grain.....	42,794	34,951	Inc.	7,843 22.4
Total, bushels.....	2,699,359	3,121,379	Dec.	430,990 13.8

Flour is reduced to wheat in the totals.

Chicago receipts and shipments of grain of all kinds from Jan. 1 to Feb. 3 were, in bushels:

	1877.	1876.	Increase.	P. c.
Receipts.....	4,612,410	4,106,213	506,197	9.9
Shipments.....	2,282,950	2,075,323	207,627	10.0

##### St. Louis Bridge Traffic.

The Union Railway & Transit Company reports the number

of cars passing over the St. Louis Bridge for the year ending Dec. 31 as follows:

Passenger cars.....	69,902
Loaded freight.....	72,772
Empty freight.....	54,366

Total.....197,039

The smallest number of cars was 13,003, in January; the greatest, 22,814, in December. Freight business was heaviest in November and December and lightest in January and July. The number of passenger cars was greatest in July and October and least in February and April.

##### Petroleum Movement.

Stowell's Petroleum Reporter gives the total product of crude oil for 1876 at 8,968,906 barrels. The shipments, reduced to its equivalent in crude oil, were 10,191,452 barrels.

Pittsburgh shipments of refined for December were: Pennsylvania Railroad, 84,827; Baltimore & Ohio, 72,228; total, 157,055 barrels.

##### Railroad Earnings.

The following are from the report of the Wisconsin Railroad Commissioner for the year ending Sept. 30, 1876:

	1875-76.	1874-75.	Increase.	P. c.
Green Bay & Minnesota.....	\$205,799	\$203,368	\$2,431	1.2
Mineral Point.....	85,080	81,380	3,700	4.6
Sheboygan & Fond du Lac.....	83,092	85,552	2,460	2.9
Wisconsin Central.....	470,041	377,644	92,397	24.5
Wisconsin Valley.....	192,458	171,670	20,788	12.1

Other earnings have been reported as follows:

	1875-76.	1874-75.	Inc. or Dec.	P. c.
Indianapolis, Bloomington & Western, Main Line.....	\$1,372,021	\$1,173,438	Inc.	\$198,583 16.9
Expenses.....	1,035,438	1,054,321	Dec.	18,883 1.8
Net earnings.....	\$336,583	\$119,112	Inc.	\$217,471 182.6
Earnings per mile.....	6,487	5,548	Inc.	939 16.9
Per cent. of expenses.....	75.47	89.85	Dec.	14.38 16.0
L. B. & W., Western Extension.....	186,397	151,101	Inc.	35,296 23.4
Expenses.....	192,744	151,063	Inc.	41,681 27.6
Deficit, or net.....	\$6,347	738	.....	.....
Earnings per mile.....	1,417	1,149	Inc.	268 23.4
Per cent. of expenses.....	103.40	99.98	Inc.	3.42 3.4

Year ending Dec. 31: 1876. 1875.

Atchison, Topeka & Santa Fe.....	\$2,486,583	\$1,520,358	Inc.	\$966,225 63.6
Expenses.....	1,175,489	698,760	Inc.	476,729 68.2
Net earnings.....	\$1,311,094	\$821,598	Inc.	\$489,496 59.6
Earnings per mile.....	3,568	2,774	Inc.	794 28.6
Per cent. of exps.....	47.37	46.96	Inc.	1.31 2.9
Central, of Iowa.....	715,526	738,760	Dec.	23,234 3.2
Expenses.....	534,361	.....	.....	.....

Net earnings.....	\$181,165	.....	.....	.....
Earnings per mile.....	3,517	\$3,909	Dec.	\$392 10.0
Per cent. of exps.....	74.50	.....	.....	.....
Chicago & Northw'n.....	12,467,540	\$12,811,227	Dec.	\$343,687 2.7
Chicago, Mt. Vernon & Delaware.....	376,053	426,028	Dec.	49,975 11.7
Galveston, Houston & Henderson.....	581,773	554,417	Inc.	27,356 4.9
Expenses.....	272,356	337,789	Dec.	65,433 19.4

Net earnings.....	\$309,417	\$216,628	Inc.	\$92,789 42.8
Earnings per mile.....	11,635	11,088	Inc.	547 4.9
Per cent. of exps.....	46.81	60.93	Dec.	14.12 30.2
Union Pacific.....	12,848,725	11,993,832	Inc.	\$854,893 7.0

Ten months ending Nov. 30:

Alabama & Chattanooga.....	\$189,639	.....	.....	.....
Expenses.....	161,681	.....	.....	.....
Net earnings.....	\$27,958	.....	.....	.....
Earnings per mile.....	643	.....	.....	.....
Per cent. of exps.....	85.27	.....	.....	.....

Six months ending Dec. 31:

Louisville & Nashville.....	\$2,755,000	\$2,564,301	Inc.	\$190,799 7.4
Expenses.....	1,621,838	1,542,754	Inc.	79,084 5.1
Net earnings.....	\$1,133,162	\$1,021,547	Inc.	\$111,715 10.9
Per cent. of exps.....	58.87	60.13	Dec.	1.26 2.1

Chicago, Dubuque & Minnesota and Chicago, Clinton & Dubuque.....	185,820	211,784	Dec.	25,964 12.3
Expenses.....	134,043	173,913	Dec.	39,870 22.9

Net earnings.....	\$51,777	\$37,871	Inc.	\$13,906 36.7
Per cent. of exps.....	72.19	82.10	Dec.	10.00 12.2

Month of December:

Chicago & Northw'n. Cleveland, Mt. Vernon & Delaware.....	\$909,640	\$932,339	Dec.	\$22,699 2.4
Union Pacific.....	27,696	32,086	Dec.	4,390 15.3
Expenses.....	952,851	963,151	Inc.	10,300 1.1

Month of January:

Chicago, Milwaukee & St. Paul.....	\$375,000	\$327,546	Dec.	\$147,454 29.0
St. Louis, Iron Mountain & Southern.....	307,500	327,190	Inc.	19,690 6.4
St. Louis, Kan. City & Northern.....	240,042	246,530	Dec.	6,488 2.6

Third week in January:

Atchison, Topeka & Santa Fe.....	\$31,846	\$27,159	Inc.	\$4,686 17.2
Denver & Rio Grande, Main Line.....	4,660	6,477	Dec.	1,817 37.9
Denver & Rio Grande, Trinidad Ex.....	2,197	.....	.....	.....
Canon City Br.....	1,439	.....	.....	.....

Week ending Jan. 13:

Grand Trunk.....	\$30,700	\$33,700	Dec.	\$3,000 9.0
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The Denver & Rio Grande notes \$1,287 contractors' freight included in 1876, reducing the decrease on ordinary traffic to \$530; the earnings of the Trinidad Extension were also decreased by snow blockade.

#### PERSONAL.

—Mr. Abram Hivling, for many years a director of the Little Miami Railroad Company, died recently at his residence in Xenia, O.

—Mr. George Rice, for many years Roadmaster on the Philadelphia, Wilmington & Baltimore, and later one of the contractors who built the Wilmington & Reading road, died in Wilmington, Del., Jan. 26.

—Mr. A. L. Hopkins, Receiver of the Toledo, Peoria & Warsaw, was to be married in Chicago, Feb. 8, to Miss Ellen M. Dunlap, daughter of Mr. George L. Dunlap, formerly General Manager of the Chicago & Northwestern.

—It is now ascertained that John T. Hill, Treasurer of the Seaboard & Roanoke Company, who lately disappeared, is a defaulter to the company for an amount not yet definitely known, but believed to be large. It was at first thought that Mr. Hill had committed suicide, but it is now believed that he has run away. The company will probably lose little or nothing as Hill's bondsmen are good.





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## Editorial Announcements.

**Passes.**—All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.

**Addresses.**—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

**Advertisements.**—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, except in the ADVERTISING COLUMNS. We give in our editorial columns our own opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

**Contributions.**—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

## A NATIONAL RAILROAD BUREAU.

Mr. Garfield has complied with the suggestion made by Mr. Charles Francis Adams, Jr., and introduced into Congress a bill providing for Government investigation of railroad accidents, and, we suppose, for the collecting of railroad statistics by a United States official for all the railroads in the United States. There will probably be some difference of opinion as to authority of the general government to legislate concerning railroads in the States, at least so far as regards railroads wholly within one State; but that is a subject we will not consider. If constitutional, would it be desirable?

So far as the investigation of accidents is concerned, it seems to us that great service might be done by Government inspectors, if properly qualified men were in the first place selected, and afterwards kept permanently at that work. This is no experiment. Great Britain furnishes an example exactly in point. Captain Tyler, the present President of the Grand Trunk Railway of Canada, an officer of the Royal Engineers, has been "Chief Inspector of Railways" for the Board of Trade for we know not how many years. In that capacity he has had charge of the investigation of all the serious accidents in Great Britain that it was thought proper to inquire into, and has made the investigations personally or through other officers under him. Evidently the years of practice in this particular work give facility and skill in it, such as can hardly be obtained in any other way. The blundering work sometimes made by skilled railroad men in seeking for the causes of accidents shows that something more is needed in this work than familiarity with railroad appliance and the working of railroads, indispensable as such knowledge is. The man who makes everything go right may be very slow to discover what on some occasion has made things go wrong. Experience in such matters will tell, as it does everywhere else, and the widest experience could be had only by examining into many accidents on different roads; at least it is to be hoped that no one road gives its officers sufficient experience to enable them to become "experts" in such investigations.

It seems, then, probable that if we had such investigations we should more frequently arrive at the true causes of the

accidents occurring, both from the greater skill of the examiners, and the large number of examples from which generalizations could be drawn by all who read their reports.

The inspectors, it will be remembered, like their English exemplars, have their powers limited to examining, reporting, and recommending; they would point out, if they could, the remedy for accidents like the one investigated, and leave it to the companies to provide it, or to the legislature to make laws concerning it. They would not make regulations, nor command the adoption of appliances. In England this method seems to have worked excellently. It concentrates public opinion, and brings home responsibility in a way that the railroad companies do not like to face, unless they are sure that there is a mistake in the conclusions of the inspectors; and it is apparent that the introduction of approved safety appliances and better methods of working has been hastened by the inspectors' reports. A company does not like to have it reported twice that a collision could have been prevented by the adoption of the block system on a certain part of its line; or that lives were lost because of insufficient brake power.

In regard to the collection of national railroad statistics, there will doubtless be considerable opposition by railroad companies, especially in States where new no reports are required, and in those others where the existing officials have made burdensome requirements which it is feared that a national office might increase. But we believe that there is at least one class of companies which will rejoice at a national bureau if it will relieve them from the duty of reporting to the bureau of the four or five different States through which their lines run, and from dividing up sums to show the "proportions for this State," which is so often an absolutely needless task. Certainly, if we are to have any official statistics, we should have them for all railroads, and all for the same fiscal year, on one general form, so that the things comparable may be compared, and the same statement may mean the same thing in all reports.

Doubtless, however, such a bureau, especially if authorized to change its requirements at will, might be very harassing, and needlessly so, to the railroad companies. Officials who do not have to keep the books and make the computations and preserve the data do not always appreciate the labor and expense required to furnish some piece of information which some one may have desired. It is true that the railroad companies are more likely to overrate the cost and underrate the value of accurate records of facts than officials or others are to do the contrary; but nevertheless it is easy to demand statements which can be of only trifling use, or none at all, or quite misleading even, and cause considerable trouble thereby. It is to be hoped that if a national form of report is adopted, it will be after very careful study, and with the co-operation of the companies which must make the reports in accordance with it. We do not mean that the companies should draw up the form to suit themselves, but that they should be fully heard, and that their reasonable suggestions should be complied with. Indeed, a considerable part of the statistics of the best Government reports are of infinitely more value to the railroad companies than to anyone else. In Germany the association of companies known as the German Railroad Union (including State and private railroads and pretty nearly all in Germany and Austria) has so much valued uniform statistics that it collects and publishes them itself for the lines included in it. (A brief abstract of one of these, or rather a collection of facts from it, was published in the last number of the Railroad Gazette for 1875.) Recently the officers of the transportation motive power and road departments of the lines in this Union have drawn up an elaborate form for reporting the wear of rails of different kinds under different circumstances. Evidently, the facts which closely affect the working of railroads are of more interest to railroad men than to others, and their advice ought to be taken whenever it is proposed to have such facts reported.

There is hardly any civilized country except this which does not collect official railroad statistics. The English reports are brief, quite simple, in some respects excellent, but in others very defective. British railroads have to report twice a year to their stockholders according to a form prescribed by law. There seems to be no complaint as to the requirements, on the part of the companies. French railroads are almost a part of the Government (though all owned by companies), and of course they report. So do the Belgian roads, a large part of which the State owns. In Germany the reports seem to have become a good deal of a nuisance; there is an Imperial report and a Prussian report and a Saxon report, and the before-mentioned report of the Railroad Union. Considerable complaint is made there of the burdens so imposed. Austria-Hungary has not had reports long, but has recently, we believe, made a new form, which was agreed upon by a congress of railroad representatives with which the officials consulted. Things have not worked very smoothly there. The reports of the other European countries we know little about.

In this country, New York has had reports by a single

form for 26 years. Other States which require statistical reports at this time are Massachusetts, Connecticut, Pennsylvania, Ohio, Michigan, Illinois, Wisconsin, Minnesota, Missouri and California. No reports have been made as yet under the laws of the last two States. The first Ohio report was for 1867; the first Massachusetts, for 1868-69. New York and Pennsylvania had reports later; but all the rest, we believe, date after the beginning of the Massachusetts Commission. Thus it appears that the States are rapidly adopting the practice of requiring reports from the railroads; and at this rate, nearly all of them will have reports soon. It will hardly be denied that it will be better to have one body of reports for the United States than to have thirty odd separate reports for different States; and it will certainly be much easier to make them, if the national report is at all reasonable.

## UNIFORMITY IN THE CONSTRUCTION OF RAILROAD CARS.

Occasionally it happens that a railroad manager, in studying economy, will look into this subject and be surprised to find how much the cost of car repairs is increased by the diversity of form, proportions and design of the parts of cars. In any car repair shop testimony may be found of the immense supply of materials, consisting of duplicate parts, which it is necessary to keep on hand in order to be able to repair "foreign" cars. Of course this evil is much greater on those roads which do a large through business than it is where comparatively few cars from other roads are hauled. But with the immense development of the railroad system, hardly any line is now exempt from the necessity of carrying a large proportion of its freight in the cars of other companies, and of sending its own over other lines. Cars loaded in Boston may not be unloaded until they get to San Francisco, and a cargo of grain intended for an interior town in New England will be taken on board at the farmer's door on a Western prairie. Doubtless this system of the interchange of cars will continue to increase, so that cars will become a sort of circulating medium on railroads, like postal currency among the people. It is therefore a matter of constantly increasing importance that a system should be adopted whereby their repairs shall be facilitated as much as possible. At present if a journal bearing requires renewal in a car away from home, one must be selected from a score or two of different patterns. The same is true of other parts, and of course the chances of error are increased immensely by the diversity, and many a hot box and other accident has been due to the use of a wrong piece in making repairs.

In the use of screw threads, however, the greatest inconvenience is experienced. Not only is there no common number of threads to the inch in use, but not the same diameters are employed in screws which are nominally of the same size. Thus, some manufacturers will make a  $\frac{1}{2}$  in. screw bolt one-thirty-second of an inch larger in diameter, because, they say, merchant bar iron always exceeds its nominal size, and therefore it is inconvenient to diminish the size of a bolt made of such iron in cutting its thread. Then, too, the forms of the threads of screws are not alike. The sides of the threads of one maker will have one angle while those of another will be quite different. The point and root of the threads in one case will be sharp, in another round and in still another flat, so that it is utterly impossible to be certain that nuts used for repairs will fit the bolts for which they are intended.

This condition of things could of course not remain long unnoticed, and now for several years past it has been an annual subject for discussion at the Master Mechanics' and Master Car-Builders' Associations. Each of these, as our readers know, have adopted what is called the Franklin Institute standard system of screw threads. This system was devised by Mr. William Sellers, of Philadelphia, and was then submitted to a committee appointed by the Franklin Institute to consider and report upon a standard system of screw threads, who recommended its adoption by the Institute. After this action was taken, it was adopted by the army and navy departments of the United States, and afterwards by the two railroad associations already referred to. It will thus be seen that it has all the authority which such action can give to sanction its use, and more than any other system to make it the standard of this country. Unfortunately, however, while the members of the two railroad associations have in their corporate capacity sanctioned its adoption, it is to be feared that but few have actually put it into practical use. We have never yet learned of specifications for cars having a clause stipulating in the clearest and most unequivocal way that the Sellers system of threads should be used. If such a clause was inserted, we doubt very much whether it would be observed unless some special effort was made to compel the builders of cars to get taps and dies made to conform accurately to that system. The reason for this is that so few master mechanics or car-builders know what the system is. Many of them have a vague notion that there has been a



system adopted which specifies the number of threads of screws to an inch, but that it does more than this few either know or seem to care. If, therefore, a clause was inserted in the specifications, stipulating that this system must be used, unless special pains were taken to have it observed, probably the only result would be, that the builder of the cars might select from among his old taps and dies such as had the number of threads to the inch required by the Sellers system, and then imagine that he had entirely fulfilled the requirements of the specification. Now, we wish to impress as strongly as we can that this system is much more than this. It specifies, first, the number of threads to an inch for different sizes of screws; second, the angle of the sides of the threads; third, the form and proportions of the point and root of the teeth; and fourth, the exact diameter of the screw over the outside of threads. Those of our readers interested in the subject and not perfectly familiar with the features of the system would do well to procure from Messrs. William Sellers & Co., of Philadelphia, a pamphlet which they have published and in which all the features of the system are fully described. The substance of this pamphlet has been condensed in Part XVI. of the Catechism of the Locomotive, by M. N. Forney.

It would, of course, be impossible to effect a universal reform at once in the use of screw threads on any railroad or in any shop, but the system described may be adopted in all new work. It is, however, of the utmost importance, that the taps and dies employed for cutting the screws on that system should be made accurately, and then that the duplicate tools which must afterwards be used in making repairs of this new work should also be accurate. In buying taps and dies care must be exercised to be sure that they conform to the standard exactly. For this reason, in every tool room of a railroad shop, there should be a set of gauges by which taps and dies could be tested. In order to secure good workmanship, supervision must not end here. The manufacturers of nuts, like nearly all other persons in business the world over, have been and are still more interested in furnishing to their customers such articles as they want than in effecting a reform in existing practices. For this reason it will be found that the holes in many of the nuts which are sold are not punched of the right size for the Sellers standard screws. Every shop, therefore, should have a set of gauges for testing the size of the holes in nuts, and each lot received should be inspected to see whether they conform to the standard of the gauges.

In discussing this subject with different persons, we have found that there is considerable confusion in the minds of some regarding the standard system of screw threads. That which has been referred to was devised, as stated, by Mr. William Sellers of Philadelphia, and should be known by his name. As it was submitted to and approved by a committee of the Franklin Institute, it is often called the "Franklin Institute standard." It was afterwards adopted by the army and navy departments of the United States and is therefore sometimes called the "United States" standard. Another system described in Haswell's Engineers' and Mechanics' Pocket-Book is also called the "United States" standard, so that to avoid ambiguity it is best to call the system which the Master Mechanics' and Car-Builders' associations have adopted the "Sellers system," which will prevent its being confused with any of the others. The bolt and nut makers have also a system of their own, and the "Whitworth" system is the one generally used in Europe, so that it is important to designate as clearly as possible which system is meant, and also to use every possible means of having one only used on railroads.

To secure uniformity in other parts of cars, it is quite as necessary to establish some system for them as it is for screw threads. Being more complicated in their construction than bolts and nuts, the other parts do not, perhaps, admit of being restricted within such absolutely inflexible mathematical limits as screw threads, but there must be some recognizable law as the foundation of the rules for the construction of those parts which are intended to be interchangeable. The gauge of the road is the first and most important element. Fortunately, there now is little doubt but that all the principal roads in this country will, before many years, conform to the 4 ft. 8½ in. gauge as the standard. The only disturbing element to this tendency is the modern narrow-gauge infatuation. The next most important dimension is the distance from the centre of one journal of a car axle to the other, and then the size of the journal itself.

With these distances fixed, it is possible to construct the other parts of a car-truck of uniform proportions, but until the size of journals and their distance apart are determined it is impossible to establish any common standard for the other parts. It was therefore very natural that in considering this subject the members of the Car-Builders' Association should first try to establish a common standard for the three dimensions named. As the length of the journals has much to do with determining their distance apart, the discussion soon became

narrowed down to that of the best diameter and length of journal for a standard axle. It was with reference to that question that there was the most contention and the greatest difference of opinion. A considerable proportion of the members thought, and doubtless very wisely, that in adopting a standard to be followed in the future they should be governed by what were likely to be the future requirements and not by past experience. They had observed the almost universal tendency in the construction of cars to an increase in their weight, and they also took into account the fact that the size of journals had not been enlarged in proportion to the increase of the weight. Some of the members had experimented with axles having journals 4 in. in diameter and 7 in. long, with most excellent results. Others who had studied the subject of friction and lubrication had learned by observation and experience that the less the pressure per square inch at a given speed, the easier it is to keep journals lubricated and the less their wear. They very naturally inferred therefor that by increasing the size over those ordinarily used the less danger there would be from heating and the less would be the frictional resistance. Practically, therefore, the association became divided into two parties, the one in favor of a journal 3½ in. in diameter, and the other in favor of 4 in. The advocates of the latter were, however, a minority; but they made up in earnestness, which was the result of intelligent conviction, what they lacked in numbers, and in the discussion of the subject they presented their views so forcibly that they succeeded in winning over to their side a sufficient number to carry a compromise measure, which consisted in the adoption of a resolution recommending an axle with a journal 3½ in. diameter × 7 in. long for a standard. It was, however, very singular how many of those who opposed the adoption of a large journal allowed ideas which had no foundation of fact to rest upon and which were to a great extent imaginary to influence their views. One master mechanic who objected strongly to the adoption of so large a journal because it increased the "dead weight" too much found on inquiry that the weight of the standard with a large journal was less than that of the axles he was using with small journals. Many objected in the strongest way to journals ½ in. larger in diameter, because the frictional resistance would be greater, owing to the "increased leverage" due to the larger diameter. This opinion was not based upon experiment or calculation, it was simply a vague notion which was adopted as a reason very much as people account for otherwise inexplicable phenomena by attributing them to "electricity," or as the newspapers account for the failure of iron bridges and other structures by saying that it was the result of "molecular disturbance caused by vibrations." This leverage theory made it impossible for some even to entertain the idea that by exposing a larger surface to friction the pressure per square inch would be less, and that thus more perfect lubrication would result, and, therefore, the co-efficient of friction would be diminished, which would offset the effect of greater leverage, and at the same time avoid the inconvenience of hot boxes and diminish the danger from broken axles.

The standard axle with a 3½×7 in. journal was, however, adopted by a vote of the majority, and since then has been used extensively on a number of roads, and always with great success and satisfaction; and we have yet to learn of a single person who, having tried it, is disposed to go back to a smaller size; nor have we yet heard of an active opponent of the standard because it is too large who has ever had any experience in the use of large journals.

Those who feel disposed to adopt a standard axle should, however, remember that the matter of greatest importance is the general adoption of some standard, even though it may not be the best possible. It may and probably will be that in order to adopt any standard many railroad men must sacrifice some of their opinions and prejudices. The committee appointed by the Car-Builders' Association a few years ago reported 105 different standard axles in use, which all, or nearly all, differed from each other. Surely some condition of things is better than this. It would be better to adopt almost any standard than to have such diversity.

#### State Surveys.

A survey of the State of New York was provided for by a law passed about a year ago, but the appropriation made was not paid over by the then Controller and present Governor Robinson, who in his late message protested against the work as uncalled for. There are times, of course, when the State, like individuals, must limit its expenditures to what is immediately necessary; for there is a bottom to the State Treasury as well as to the pockets of its citizens, though many intelligent people are apt to forget it; but a good State survey would be a most profitable investment of money, and it is a reproach to the civilization of the country that so far so little has been done in that direction. During the Centennial we took occasion to call attention to some of the magnificent maps of Government surveys exhibited by Great Britain, Switzerland,

and some other countries, and cited them as examples of what ought to be done in this country and what, we are sure, will be done some day, and for which we shall suffer inconvenience and expense until it is done. It seems absurd, but it is true, that in many respects the topography of the wilderness in Colorado and New Mexico is more accurately recorded by the labors of Wheeler, Powell and Hayden, under the auspices of the general government, than is that of the wealthiest and most populous States of the Union. Mr. Gardner, of the New York State survey, has said that a State survey would have prevented the sinking of \$20,000,000 in the New York Midland Railroad. Perhaps so; but if not, it would have permitted an enormous saving in the cost of the railroads projected and constructed heretofore and to be surveyed hereafter. Few people know what an amount of labor has been expended in railroad surveys in this country, and in how many cases the work has been done over and over again. In the newer States, even, the engineer seeking for the most practicable route often stumbles upon the stakes which mark the track of some predecessor, or three or four predecessors, who were engaged in the same task in the same place, perhaps only a few years before, but of whose work no record is accessible, if any exists. And this leads us to observe that if records were collected and preserved of all the railroad surveys which have been made in this country, we should have a large part of the material necessary for an accurate and tolerably minute topographical map of many of the States. The projects for which surveys were made, but which never made any further progress, may be counted by the hundreds or thousands; while of course surveys were made for other lines than the one finally built upon in the case of existing roads. It is painful to contemplate the enormous waste of valuable and costly material due to the failure to preserve records of these surveys. These surveys were private property, and at one time were supposed to be valuable as such; but their utter destruction in so many cases suggests the policy of requiring maps of all surveys, whether built upon or not, to be deposited at the capitol as part of the records of the State. It is a public misfortune that so much good work should be thrown away.

If a State survey is to be undertaken, now, unless the condition of the finances absolutely forbids, is a favorable time to begin it. There is in the country a large force of skilled surveyors, trained during the recent great activity in railroad construction. Any number desired of such men can now be had at very low prices. We would not advocate the undertaking of a survey for the purpose of giving these men work, but as the work is a desirable one, likely soon to be considered an indispensable one, and to be done some time in spite of whatever obstacles may exist, it would seem to be wise to take advantage of the circumstances which make the peculiar skill needed abundant and cheap.

#### Record of New Railroad Construction.

This number of the Railroad Gazette has information of the laying of track on new railroads as follows:

*Cincinnati & Westwood.*—Track laid (in 1875) from Brighton Station in Cincinnati to Westwood, 5 miles. It is of 3-ft. gauge.

The *Northeastern of Georgia*, which had been advertised as a narrow-gauge railroad, proves to be of 5-ft. gauge, like the Georgia roads with which it connects. This reduces the mileage of narrow-gauge railroads constructed in 1876 to 502 miles, and increases the total mileage of that year to 2,447.

THE METROPOLITAN RAILWAY (about nine miles of the London underground line, forming one-half of the circle which the Metropolitan District Railway nearly completes) during the year 1876 carried 52,586,395 passengers, which is 8½ per cent. more than in 1875. This traffic is equivalent to carrying 72,036 passengers both ways daily, or 3,001 per hour, or 50 per minute for every hour of the twenty-four. The road is closed for four hours during the night, we believe, so that the actual average numbers for the time worked are 3,600 per hour and 60 per minute. The receipts from this traffic were \$2,315,522 gold, or at the rate of 4.4 cents per passenger. Dividends amounting to 4½ per cent. were paid from the net earnings of the year. The total net profits of the line for the last half-year were \$751,764; the expenses having been 38½ per cent. of the receipts, making the average expense per passenger carried only 1.7 cents.

THE JANUARY GRAIN MOVEMENT was lighter than usual, for which no other explanation is needed than the terrible snow blockades. Receipts at Northwestern ports were one-eighth less than last year, nearly a quarter less than in 1875; and 5 per cent. less than in 1874. The shipments of these markets were not half of their receipts (which is common at this season) and were this year more than a third less than last year and not half as great as in 1874. The receipts at the seaboard were 36 per cent. less than in 1876, when, however, they were the largest ever known in January. As might be expected from the greater obstructions on the more northern roads, New York does not make much of a figure in January receipts. Of the total arriving at the seaboard it received but 28½ per cent., while Baltimore's share was 31½ per cent., Philadelphia's 26 per cent., and Boston's 9 per cent. Baltimore's receipts are about as large as its average for 1876, and larger than they were sometimes during navigation, when the other leading ports did their heaviest business.







ing lines, the South Mountain Iron road, 17 miles long, and the Mont Alto road, 10½ miles, both built to open up iron properties. The present report is for the year ending Sept. 30, 1876.

The equipment consists of 23 engines; 25 passenger and 6 baggage cars; 255 eight-wheel and 19 four-wheel freight cars.

The credit side of the capital account is as follows:

Preferred stock.....	\$484,900 00
Common stock.....	1,292,950 00
Total (\$21.681 per mile owned).....	\$1,777,850 00
Bonds (\$4.286 per mile).....	352,500 00
Dividend and interest account.....	69,704 20
Balance (surplus earnings invested).....	1,042,077 39

Total (\$39,414 per mile).....\$3,231,931 59

The contingent fund, representing the invested surplus, amounts to \$1,351,923.88, of which \$17,289.44 is cash; \$22,047.57 cost of 403 shares of the company's stock; \$93,532.33 Franklin stock; \$496,673.04 Southern Pennsylvania stock and bonds; \$313,381.50 Martinsburg & Potomac bonds; \$200,000 South Mountain Iron bonds; \$100,000 Dillsburg & Mechanicsburg bonds, and \$110,000 Mont Alto bonds.

The work done on the main line was as follows:

Train mileage, passenger.....	1875-76.	1874-75.	Inc. or Dec.	P. c.
" freight.....	173,633	146,803	Inc.	26.830 18.3
" freight.....	117,583	131,990	Dec.	14,407 10.9
Total.....	291,216	278,793	Inc.	12,423 4.5
Passengers carried.....	377,397	376,133	Inc.	1,264 0.3
Tons freight received at Harrisburg.....	178,543	159,179	Inc.	19,364 12.2
Tons freight shipped from Harrisburg.....	167,999	166,530	Dec.	8,431 5.1
Tons iron ore carried.....	66,825	59,410	Inc.	7,415 12.5
Tons coal carried.....	92,872	103,223	Dec.	10,351 10.0

The Centennial travel was somewhat less than was expected; it increased, however, after the close of the year. The total number of Centennial passengers carried was 15,768, of whom 6,860 were carried before Sept. 30 and 8,908 from Oct. 1 to Nov. 1. There was an increase in grain carried and also in iron ore, but a decrease in coal.

The earnings of the Main Line for the year were as follows:

Freight.....	1875-76.	1874-75.	Inc. or Dec.	P. c.
Passengers.....	\$313,215 83	\$315,653 50	Dec.	\$2,437 67 0.8
Mail and express.....	100,180 87	186,422 75	Inc.	3,758 12 2.0
Mail and express.....	14,794 30	13,775 06	Inc.	1,019 24 7.4
Miscellaneous.....	29,802 65	10,224 83	Inc.	19,577 82 191.9
Total.....	\$547,993 65	\$526,076 14	Inc.	\$21,917 51 4.2
Working expenses.....	249,892 46	265,481 34	Dec.	15,588 88 6.3
Net earnings.....	\$298,101 19	\$260,594 80	Inc.	\$37,506 39 14.4
Gross earn. per mile.....	6,682 85	6,415 09	Inc.	267 36 4.2
Net.....	3,635 38	3,177 98	Inc.	457 40 14.4
Per cent. of expenses.....	45.60	50.46	Dec.	4.86 9.6

The earnings and expenses per train mile were:

Gross earnings.....	\$1.1805	\$1.0638	\$0.1167	10.9
Expenses.....	0.5978	1.2428	0.6450	58.81
Net earnings.....	\$0.5827	\$1.4210	\$0.8383	143.9

In passenger trains there was a decrease in both gross and net earnings, due to the unusually low rates on much of the business. Freight trains showed an increase both gross and net.

The earnings of the three leased lines were as follows:

Martinsburg & Potomac.....	1875-76.	1874-75.	Inc. or Dec.	P. c.
Expenses.....	\$11,140 69	\$13,813 08	Dec.	\$2,672 39 24.0
Net earnings.....	10,216 38	12,974 96	Dec.	2,758 58 21.2
Net earnings.....	\$924 31	\$838 12	Inc.	\$86 19 10.3
Earnings per mile.....	928 39	1,151 09	Dec.	222 70 19.4
Per cent. of expenses.....	91.71	93.93	Dec.	2.22 2.3
Dillsburg & Mechanicsburg.....	22,573 44	20,659 65	Inc.	1,913 79 9.2
Expenses.....	10,913 13	12,198 20	Dec.	1,285 07 10.5
Net earnings.....	\$11,660 31	\$8,461 45	Inc.	\$3,198 86 37.6
Earnings per mile.....	2,821 68	2,582 46	Inc.	239 22 9.2
Per cent. of expenses.....	49.40	59.04	Dec.	10.64 18.0
Southern Pennsylvania.....	18,442 40	23,231 17	Dec.	4,808 77 26.2
Expenses.....	16,247 50	20,620 71	Dec.	4,373 21 20.7
Net earnings.....	\$2,194 90	\$2,610 46	Dec.	\$415 56 18.7
Earnings per mile.....	800 97	1,010 05	Dec.	209 08 26.2
Per cent. of expenses.....	88.30	88.76	Dec.	0.46 0.5

The Southern Pennsylvania showed a large increase in grain and general freights, but a great decrease in ore. The Dillsburg & Mechanicsburg showed a very large increase in ore. The business of the Martinsburg & Potomac will hardly increase until a Southern connection is secured.

The income account for the year was as follows:

Cash and balances, Oct. 1, 1875.....	\$242,194 06
Net earnings.....	298,101 19
Material used.....	1,884 76
Total.....	\$542,180 01
Dividends.....	\$221,539 75
Interest.....	36,801 75
Construction account.....	44,956 22
Contingent fund.....	192 19
State tax.....	8,658 66
Total.....	\$302,139 57

Balance, Oct. 1, 1876.....\$240,040 44

Of this balance \$62,707.54 is in balances of accounts and \$177,332.90 in cash.

During the year 800 tons of steel rails, average cost \$61 per ton, were laid, making 2,352 tons in the track. Four passenger cars were built and one bought; a paint shop built at Chambersburg and several new depots on the line; a dangerous grade crossing at Waynesboro avoided by regrading the highway and building a bridge over the track; 2,368 feet new sidings were laid. The road and equipment are in good order.

#### Galveston, Houston & Henderson.

This company owns a line from Galveston, Tex., northwest to Houston, 50 miles. It is the outlet to Galveston of the system of roads centering at Houston. The present report is that presented at the recent annual meeting, and covers the year ending Dec. 31, 1876.

The work done was as follows:

Mileage of passenger train.....	1876.	1875.	Inc. or Dec.	P. c.
" freight.....	352,370	329,202	Inc.	23,168 7.0
Mileage of freight train cars.....	1,940,217	1,332,695	Inc.	607,522 45.6
Total.....	2,292,587	1,661,897	Inc.	630,690 38.0
Average cost per car mile.....	16.5 cts.	20.3 cts.	Dec.	3.8 cts. 19.0
Passengers carried.....	88,317	77,751	Inc.	10,567 13.5
Passenger mileage.....	2,714,660	2,618,496	Inc.	96,164 3.7
Tons freight carried.....	267,238	158,902	Inc.	108,336 68.2

Nearly all the freight is through freight passing over the whole road. The earnings for the year were as follows:

	1876.	1875.	Inc. or Dec.	P. c.
Gross earnings.....	\$581,772 98	\$554,417 29	Inc.	\$27,355 69 4.9
Working expenses....	272,366 35	337,789 23	Dec.	\$65,422 88 19.4
Net earnings.....	\$309,406 63	\$216,628 06	Inc.	\$92,778 57 42.8
Gross earnings per mile.....	11,695 46	11,088 34	Inc.	547 12 4.9
Net earnings per mile.....	6,188 33	4,332 56	Inc.	1,855 77 42.8
Per cent. of expenses.	46.81	60.93	Dec.	14.12 23.2

The equipment consists of 21 engines; 9 passenger and 6 baggage cars; 154 box, 30 stock and 95 flat cars; 11 service cars.

During the past year four new engines were bought; 36,000 new ties and 2,000 tons of 56-lb. iron were laid, and the gauge of the road was changed from 5 ft. 6 in. to 4 ft. 8½ in. There are now 36 miles of track laid with fish-bar rails and 14 miles with the old chain-joint rails; 23 miles are ballasted with shell ballast. The work of replacing the old rails and ballasting the track is to be completed during the current year. The long bridge over Galveston Bay has been thoroughly repaired at a cost of \$14,000, and all the bridges on the road repaired and strengthened, especially that over Buffalo Bayou at Houston. About \$60,000 more are required to put the road in first-rate condition.

#### Illinois Central.

The report of the directors for the year 1876 has been issued, but the usual tables and statements of traffic are not yet ready. The directors say that the working of the line has been injuriously affected by three causes: Restrictive legislation and the failure of the wheat crop in Iowa; the serious injury to the corn crop of Illinois by the July rains, and the competition for Western business. These causes operated with peculiar force on the Iowa Division, the result of whose working was as follows:

Gross earnings (\$4.028 per mile).....	\$1,619,277 32
Operating expenses (68.88 per cent.).....	\$1,115,206 99
Rentals.....	626,987 56
Extraordinary expenses.....	155,225 40
Total.....	1,896,419 95

Deficiency.....\$277,142 63

Besides the light corn crop there was also a very light fruit crop in Southern Illinois. The report then refers to the railroad war and the extreme low rates, and especially to the cutting of rates by the East and West lines, which now cross the Illinois Central at several points. The rates for grain to Chicago over the road have been reduced since 1872 from 20 to 30 per cent., while lumber rates from Chicago have fallen 50 per cent. The report continues:

"Notwithstanding this condition of affairs, the result of the operation of the Illinois line down to 30th June last, were as follows:

Gross earnings.....	\$2,380,166 77
Operation expenses and tax.....	1,607,308 69

Showing a net of.....\$1,072,858 08

which was \$47,865.70 above that of the corresponding period of 1875. In June last, when the dividend of August was declared, the directors did not anticipate the full effect of the loss of traffic in the autumn months. Soon after the payment of the August dividend, these causes affecting our revenue developed themselves, and the absolute loss in gross earnings in Illinois during the last six months of 1876 was \$501,556.59, which brought the net result for the year on the whole line down to \$2,144,766.31, being \$525,305.61 less than the net result for the year 1875. In the general accounts of the company, the two dividends of February and August, 1876, are charged in the year's accounts, while in fact the August dividend and that of February, 1877, correspond to the net result for the year 1876. This net result justified the 2 per cent. dividend declared by the board payable on Feb. 1, 1877, on the basis of the following figures:

Interest on funded debt.....	\$616,792 01
Dividend of Aug. 1, 1876.....	1,160,000 00
" Feb. 1, 1877.....	580,000 00
Total.....	\$2,356,792 01
Balance to credit of income account from '75.....	109,023 56
Net result from operations in 1876.....	2,144,736 31
Receipts from Land Department.....	143,837 69
Total.....	\$2,397,637 56

"The cash balance covered the dividend declared. The indebtedness of the company is confined to its funded debt of \$10,662,000, upon which the interest was last year, with premium on gold, \$616,792.01, being less than one-third of the net revenue.

"The assets of the company, besides its property in Illinois, comprise nearly \$5,000,000 bonds of the railways from Cairo to New Orleans. Default was made in the payment of interest on these bonds, and upon application of this company, these roads were placed in the hands of a Receiver on the 10th of March last. The suit has been prosecuted with the least possible delay. Both the railways are now placed in the hands of the Trustees of the mortgages for sale, and will be sold within a few months for the benefit of the bondholders. The line is now under our control. Mr. James G. Clarke, our Second Vice-President, has been acting since Jan. 1, under orders from the Trustees, as General Manager of the entire line; 10,400 tons of iron have been laid and very extensive improvements made to the track. This company has advanced \$398,236.07 secured by the coupons on the first and second mortgages. The directors have not felt it safe to incur large expenditures upon this property until they obtain actual possession of it, which it is hoped will occur within a few months. The line has been operated in a disconnected manner. The State of Tennessee had possession of 117 miles of road lying within its borders for non-payment of interest on the debt due to the State. Managed in this disjointed way, the result of the operations of 1876 affords but little evidence of the true value of the property in efficient hands. At this time the directors will only say that from Sept. 1 to this date the business offering has been entirely beyond its capacity. Owing to want of sufficient plant, it has been compelled to relinquish at least one-fourth of the business falling naturally upon it. Sufficient results, however, have been arrived at to satisfy the directors that the local resources of this line, when it is in good order and fully equipped, are fully equal to the interest on its mortgage debts."

The report refers to the prospective value of these lines and to the development of the country through which they pass. The freight business transferred from them to the Illinois Central at Cairo for four years past was: 1873, \$151,459; 1874, \$316,553; 1875, \$422,786; 1876, \$585,238.

The report says, in conclusion:

"It is possible that Iowa will reverse its legislation, following the example of Wisconsin and Minnesota, both of which States have repealed the restrictive laws which were popular a few years since. A full harvest will again restore traffic. But the control which the Illinois Central held for many years of the transportation of the products of Central Illinois to Chicago is seriously impaired by the number of railways traversing the centre of the State in every direction. There are in actual operation, within the limits of Illinois, 7,169 miles of railroad. 25 different corporations, operating about 3,000 miles, are either actually in the hands of receivers, or having failed to pay interest on their bonded debt, are at the mercy of their creditors, and liable to be placed in the hands of receivers at any time. Our chief difficulty is in dealing with these bankrupt roads. We are urged to purchase or lease several of these roads, which can be done upon terms far below their actual cost—in some instances at 50 per cent. of their bonded debt. Your board, hesitating to incur the responsibility of such engagements, requested in November last that a committee should be named by the English and Dutch shareholders, who hold a majority of our shares, and that such committee of shareholders should, accompanied by some members of the present board, visit Illinois, and give their judgment at the general meeting of shareholders in May touching the policy which it is advisable to adopt for the general interest, either by

taking up some of the lateral lines referred to, or by extending our operations in the direction of our southern outlet.

"The board regret that during the last year they have been deprived of the valuable aid of their President, Mr. John M. Douglas, who retired from office after twenty years of service. There are also several vacancies in the direction which call for the selection of new managers.

"It is important that this committee should arrive at an early day and be prepared to submit to the shareholders their views in regard to the policy to be adopted, and as to these new appointments, for action at the annual meeting in May.

"The operations of the line will be conducted with the utmost economy, at the same time the directors will endeavor to avoid that false economy which would result in deterioration of the property committed to their charge."

#### OLD AND NEW ROADS.

##### James River & Kanawha Canal.

The firm of Mason, Shanahan & Randolph, contractors of large means, have offered to lease this canal for 20 years and to extend it, either by an extension of the canal, or by building a railroad, from its present terminus at Buchanan, Va., to the Chesapeake & Ohio at Clifton Forge. The conditions required are that the Canal Company shall provide for the present floating debt; that they shall be paid for the work on the extension in third-mortgage bonds of the company; that the State of Virginia shall furnish them with convict labor and take bonds in payment, and that the Chesapeake & Ohio Company shall be required to give the canal through rates on all traffic exchanged at Clifton Forge. The offer is now being considered by a committee of the Legislature.

##### Chicago, Dubuque & Minnesota.

The Superintendent makes the following comparative statement for this road and the Chicago, Clinton & Dubuque for the six months ending Dec. 31:

Freight.....	1876.	1875.	Inc. or Dec.	P. c.
Passengers.....	\$101,490 10	\$114,846 95	Dec.	\$13,356 85 11.6
Mail, express, etc.....	77,613 66	88,552 46	Dec.	10,938 80 12.3
Total.....	\$179,103 76	\$203,400 41	Dec.	\$24,296 65 13.6

Working expenses.....	\$185,819 63	\$211,784 36	Dec.	\$25,964 73 12.3
Renewals, improvements, wash-outs and insurance.....	106,688 54	173,912 74	Dec.	67,224 20 39.0
Total.....	\$292,508 17	\$385,697 10	Dec.	\$93,188 93 31.9

Net earnings.....	\$51,776 96	\$37,871 62	Inc.	\$13,905 34 36.7
Gross earnings per mile.....	1,043 93	1,189 80	Dec.	145 87 22.9
Net earnings per mile.....	290 88	212 76	Inc.	78 12 36.7
Per cent. working exps.....	57.00	82.10	Dec.	25.10 30.6
Per cent. all exps.....	72.10	82.10	Dec.	10.00 12.2

Total.....\$134,042 67

Net earnings.....\$51,776 96

Gross earnings per mile.....1,043 93

Net earnings per mile.....290 88

Per cent. working exps.....57.00

Per cent. all exps.....72.10

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Total.....\$134,042 67

Net earnings.....\$51,776 96

Gross earnings per mile.....1,043 93

Net earnings per mile.....290 88



restrain the directors of this company and the Pittsburgh, Cincinnati & St. Louis from canceling the lease of the road to the last-named company. The petition sets forth that such action would be very detrimental to the interests of the bondholders, and that the two boards of directors are substantially identical and seek to deprive the bondholders of their interest in the lease, with regard only to the advantage of the lessee.

#### Leavenworth, Lawrence & Galveston.

Notice is given that the Farmers' Loan & Trust Company, Trustee, will pay \$25 on each of the coupons due July 1, 1875, on presentation at its office in New York.

#### Central, of New Jersey.

A called meeting of stockholders was held in New York, Feb. 7, to consider the question of placing the certificates of indebtedness. President Knight made an address, which included the following statement for 1876:

Receipts.....	\$6,946,000
Expenses.....	3,684,000
Net earnings.....	\$3,262,000
Interest, taxes, rentals, loss on canals.....	2,811,000
Balance.....	\$451,000

Mr. Knight thought that the company had been paying too high dividends and retaining too little surplus. He believed that business was improving and that, with strict economy, the company would soon be in a good position. In answer to questions he said that the floating debt was about \$2,500,000, and that the company's endorsement was on about \$1,000,000 Lehigh & Wilkesbarre paper.

Several stockholders expressed confidence in Mr. Knight, but wanted more information. A committee was appointed to examine the books and make an immediate report. While waiting for this several speakers urged the importance of subscribing for the certificates. At the latest attainable accounts the meeting had not concluded, but very few subscriptions had been made.

#### Eastern.

The suit brought by the Eastern Railroad of New Hampshire having been transferred to the United States Circuit Court, the Receiver appointed by the New Hampshire Court has been enjoined from taking any further action. A new suit has been begun by the Attorney General of New Hampshire on information filed by some stockholders, the petition asking that they call the Eastern of Massachusetts to show by what authority it continues to operate the road in New Hampshire without paying rents or dividends for its use. It is thought that the object of the New Hampshire Company is to force some compromise whereby a change in the lease may be secured.

At the annual meeting in Boston, Feb. 5, after the reports had been read, new by-laws were passed, one providing that the annual meeting shall hereafter be held on the second Wednesday in December; that special meetings shall be called at any time on the written request of 30 stockholders, and that no proxy shall be valid unless given six months before the meeting. In answer to a question the President said that no passes were now issued on account of business sent over the road. This was partly the result of an agreement with the Boston & Maine. It was stated that the question of reclaiming misappropriated or misused property had been referred to a committee of the board, whose report is not yet ready.

#### New Jersey & New York.

A meeting of bondholders was held in New York, Feb. 6, to consider measures to secure their rights. There are four classes of bonds, Hackensack & New York first and second mortgage bonds, Hackensack & New York Extension bonds, and New Jersey & New York consolidated bonds. The road is now in the hands of a receiver appointed by the New Jersey Court of Chancery, and steps have been taken to secure a decision on the priority of lien of the different classes of bonds. The meeting appointed C. H. Voorhees, S. S. Richards, J. J. McCook and A. S. Whiting a committee to consider the position of affairs and to prepare a plan of reorganization.

#### St. Louis, Rock Island & Chicago.

A meeting of stockholders was held in Rock Island, Ill., Feb. 1, and passed resolutions authorizing the directors to execute a mortgage for \$2,500,000 on the road and to issue bonds to that amount, and also to make a lease of the road to the Chicago, Burlington & Quincy. The meeting was only formal, as the Chicago, Burlington & Quincy Company owns all the stock.

#### Dividends.

Dividends have been declared by the following companies: Pennsylvania, 2 per cent., quarterly, payable Feb. 27. Cleveland & Pittsburgh, 1 1/2 per cent., quarterly, on the new guaranteed stock, payable March 1.

#### Pennsylvania.

A large building at Trenton, N. J., formerly used as a paint shop, but lately as an engine-house, was burned on the evening of Feb. 4. There were eight engines and three cars in the house, all of which were badly damaged.

#### Atlantic & Gulf.

A meeting of bondholders was held in Savannah Jan. 31, about \$500,000 being represented. President Screven made a statement and a committee was appointed to confer with the directors of the company and to report to a meeting to be called not later than Feb. 19.

#### Southern Pacific.

The Territorial Legislature of Arizona has passed a bill exempting this company's property from taxation for four years and authorizing charges of ten cents per mile for passengers and 15 cents per ton per mile for freight.

#### Philadelphia & Atlantic City.

It is said that arrangements have been made to begin work near Camden, N. J., in a short time. The company claims to have made contracts with the Bethlehem Iron Company for 3,500 tons of steel rails, 40 lbs. to the yard; with the Baldwin Locomotive Works and W. H. Bailly & Co., for eight engines, and with Bowers, Dure & Co., for a number of cars.

#### Wabash.

One span of the bridge over the Wabash River at Logansport, Ind., was carried away by floating ice, Feb. 3. The bridge was being replaced by an iron one and a part of the iron work for the new bridge was also carried away.

We have already noted the coupons on the outstanding bonds which the new company proposes to fund. For the funded coupons it offers to give 7 per cent. scrip certificates, which may be funded in 7 per cent. 30-year bonds, to be known as the funded debt bonds, which are to be redeemable after 1882 at the rate of \$100,000 per annum. The coupons so funded are not to be destroyed, but to be held in trust and to remain as a lien in case any default should be made hereafter in the interest on the funded debt bonds or scrip certificates.

#### Columbus & Toledo.

This company is now running two regular trains over the whole line of its road. The stations, with the distances from Columbus, O., are: Elmwood, 9 miles; Powell, 14; Hyatt's, 18; Delaware, 24; Radnor, 31; Prospect, 36; Owen's, 41; Marion, 48; Morral, 53; Fowler, 57; Upper Sandusky, 64; Tymochtee, 71; Carey, 74; Alveda, 81; Baltimore & Ohio Crossing, 87; Fostoria, 88; Rising Sun, 96; Bradner, 100; Pemberville, 105; Maumee

Pike, 112; Walbridge, 117; East Toledo, 120; Toledo, 123. The five miles from Walbridge to Toledo are run on the track of the Pennsylvania Company's Toledo Branch.

#### Sycamore & Cortland.

The name of this road has been changed to Sycamore, Cortland & Chicago. The road is 4 1/2 miles long, from Sycamore, Ill., southward to Cortland on the Chicago & Northwestern.

#### California Pacific.

Contracts have been made for 30,000 ties and 1,000 tons of rails to be used in the extension of the Vaca Valley Branch from its present terminus at Winter's, Cal., to Madison in Yolo County. The ties and iron are to be delivered in April.

#### Pittsburgh & Northwestern.

This company is going to build at once a section of 10 miles from Evergreen, Pa., near Pittsburgh, northward. From Evergreen the company owns the Lawrenceville & Evergreen road, whose other terminus is on the Western Pennsylvania road in Allegheny, near the Forty-third street bridge. At this point the company intends to cross the Allegheny River and run down the Pittsburgh side of the river to Eighth street, where the Pittsburgh depot will be built. Money to pay off old debts and build this 10 miles has been furnished by some New York parties, and it is expected that local aid and subscriptions can be secured to carry the road through to Youngstown.

#### Chippewa Falls & Western.

It is said that preparations are being made to extend this road from its present terminus at Chippewa Falls, Wis., northward to a connection with the Wisconsin Central in Taylor County.

#### Fort Dodge & Fort Ridgely.

This company has resolved upon a change in the line of its projected road. The new plan is to use the Illinois Central track from Fort Dodge, Ia., west about 15 miles, and then run north through Pocahontas, Palo Alto and Emmet counties and to a point in Martin County, Minn. The change is caused by some trouble as to the promised subsidy from Humboldt County.

#### Indianapolis, Bloomington & Western.

The strike on this road is over, the enginemen having agreed to continue at work on the present rates of pay for one year.

The Receiver has asked the Court for authority to issue certificates of indebtedness for the purpose of paying off back pay and supply claims. Argument on the application was to be heard this week.

#### St. Louis & Toledo Air Line.

T. J. Reynolds & Co., contractors for this road, will receive at their office in Shelbyville, Ill., until Feb. 13, proposals for clearing, grading, masonry, timber-work, bridging and track-laying of the road from Shelbyville to Arcola, 40 miles. Bids will be received for the whole or any part of the work.

#### Atlantic, Mississippi & Ohio.

The Lynchburg (Va.) *Virginian* says that the representatives of the bondholders have agreed to make no opposition to an order directing the Receivers to apply a part of the net earnings of the road to the payment of the back wages accruing before the appointment of the Receivers.

#### Albert.

This road is now completed from the junction with the Intercolonial at Salisbury, N. B., southeast to Hillsboro, in Albert County, 24 miles, and that section was formally opened for travel Jan. 29. The line is graded to Hopewell Corner, 21 miles further, and will, it is expected, be completed in the spring. The line has a subsidy from the Province, and has been built by Mr. A. E. Killam, as contractor.

#### Cincinnati & Terre Haute.

This road was sold under foreclosure of the first mortgage in Terre Haute, Ind., Jan. 31, and was bought by W. R. McKee, W. B. Buell and Josephus Collett for \$75,000. It is completed and in operation from Terre Haute southeast to Markland, 26 miles, and is graded for some 15 miles further.

#### Baltimore, Philadelphia & New York.

The property of this company, consisting of some miles of graded road bed, right of way and the franchises, was sold in Towson, Md., Jan. 30, under a judgment obtained by Walter Scott, contractor. The property was bid in by Mr. Scott for \$1,524. It is said that he has made arrangements to complete the road from Towson to the Relay House on the Northern Central, about three miles.

#### East River Bridge.

At a meeting of the trustees held Feb. 5, a slight change in the line of the New York approach to the bridge was decided on. Requisitions were made on New York for \$500,000 and on Brooklyn for \$1,000,000 to carry on the work.

The trustees call for proposals for two spiral stairways of iron to extend from the docks to the roadways at the New York and Brooklyn towers, about 120 feet; also for fire-proof roofs for several buildings on the line of the approaches. Further information can be obtained at the office, No. 21 Water street, Brooklyn, N. Y.

#### Painesville & Youngstown.

In the United States Circuit Court in Cleveland, O., Feb. 5, the Farmers' Loan & Trust Company, of New York, Trustee, filed bills for the foreclosure of the first and second mortgages on this road. The road, which is of 3 ft. gauge, is 61.8 miles long, from Fairport, O., to Youngstown; by the latest report there were \$993,000 first and \$250,000 second-mortgage bonds outstanding.

#### Buffalo & Jamestown.

In the suit of the Farmers' Loan & Trust Company, Trustee, against this road, the New York Supreme Court has granted a judgment of foreclosure of the first mortgage and an order for the sale of the road. The Court appointed George S. Wardwell Referee to sell the property and to ascertain the amount due under the mortgage.

#### Louisville & Nashville.

All the locomotive firemen on the Louisville Division struck on the evening of Feb. 1 in consequence of an order requiring them to do the cleaning and other work heretofore done by the wipers. The company at once paid off the strikers and engaged new men in their places. The men claimed that they had already submitted to a reduction in wages and that the extra work required is more than they can well do.

#### Baltimore, Ohio & Chicago.

A meeting of stockholders is to be held in Garrett, Ind., Feb. 21, to vote on the question of authorizing the execution of a mortgage of \$8,000,000 on the road, which is the Baltimore & Ohio's Chicago Division.

#### Denver, South Park & Pacific.

This company has executed a mortgage for \$2,500,000 upon its property to the Farmers' Loan & Trust Company, of New York, as trustee. It is proposed to issue bonds under this mortgage to complete the road to Fairplay, some 70 miles southwest of Denver. The road is now completed to Morrison, Col., 16 miles from Denver.

#### Kansas Pacific.

The officers of this road, having had much trouble from the loss of goods from freight cars, recently put the matter in the

hands of detectives, who, on Feb. 2, succeeded in arresting nine men at Carson, Col., who had been engaged in robbing the cars. A large quantity of goods was found secreted near Carson.

Local papers state that the officers of the road are not satisfied with the results of the long-run system for engines, and are making arrangements to go back to the old plan under which the runs were about 100 miles.

#### North Wisconsin.

Contracts are being let for clearing out the right of way from the present terminus at Clayton, Wis., northward through Barron County. This work is in preparation for a commencement on the grading in the spring.

#### Gulf, Western Texas & Pacific.

Surveys have been begun for the extension of this road from Cuero, Tex., to Gonzales, about 30 miles. Two lines are to be run, one east the other west of Guadalupe River.

#### Utah Northern.

The proposition submitted to the Legislature of Montana on behalf of this company is for an extension of the road from its present terminus at Franklin, Idaho, to a point in Montana near the mouth of the Big Hole River, about 300 miles. The company is to build 100 miles each year until the line is done, and to receive the 8 per cent. currency bonds of the Territory of Montana at the rate of \$5,000 per mile, the bonds to be placed in trust in New York and issued as the work progresses. The Legislature of Idaho Territory has refused to grant the company any subsidy for the road in that Territory.

#### St. Paul & Pacific.

The Minnesota Legislature is still occupied in considering the questions of granting an extension of time for the completion of this road and of removing the prohibition against the building of a line to connect the road from Glynndon down the Red River with the First Division at Breckenridge.

In the United States Circuit Court at St. Paul, Feb. 1, Wm. Welsh and R. Patterson, two bondholders, recovered judgment for \$15,521.50 on unpaid coupons. The Court held that the Trustees' suit for foreclosure was, under the Minnesota statute, no bar to these individual proceedings.

#### Miami Valley.

This company has resolved to change the line of its projected road so as to make Columbus, O., the northeastern terminus of the line instead of Xenia, as originally intended. The Chief Engineer has been over the proposed new line, and complete surveys are to be made. The road is now under contract from Cincinnati to Waynesville, and no change will be made in that part of the line.

#### Scioto Valley.

Arrangements are being made to begin work on the extension of this road from Chillicothe, O., southward to Portsmouth. An earlier commencement of the work has been prevented by the failure of subscribers to the stock to pay up. It is said that a considerable amount of the company's bonds has been negotiated at 85.

#### Boston & Albany.

At the annual meeting in Boston, Feb. 14, the stockholders are to vote on a new agreement with the Pittsfield & North Adams Company, which is then to be submitted to them, and also on an agreement for a lease of the North Brookfield Branch. The Pittsfield & North Adams road is already leased, and has been for a long time.

#### Brattleboro & Whitehall.

The organization of this company was completed at a meeting held in Brattleboro, Vt., Feb. 1. The new company will at once begin the work of securing subscriptions and taking other measures to raise the money necessary to build the road. A considerable amount has already been secured and two towns have voted to grant aid. The road is to run from Brattleboro, Vt., northwest to Whitehall, N. Y., about 75 miles.

#### Joggins Branch.

Surveys are being made for a railroad about 10 miles long from the Joggins coal mines in Cumberland, Nova Scotia, to the Intercolonial at Maccan. The road would open up a large coal district.

#### European & North American.

The repair shops of the Western Division at Carleton, N. B., was destroyed by fire on the morning of Jan. 25 with all the tools and machinery. Two cars were also burned and an engine damaged.

#### New Brunswick.

The extension of this road northward through the St. John Valley to Little Falls and thence to Riviere du Loup is being strongly advocated. There are 141 miles to be built, of which 62 are in New Brunswick and 79 in Quebec, and it is thought that the extension can be secured if Quebec will grant a subsidy. By this route the distance from St. John to Riviere du Loup is 306 miles, against 463 by the Intercolonial, and from the 62 miles in the St. John valley a considerable local traffic can be secured, chiefly in lumber.

#### Chicago, Rock Island & Pacific.

The town of St. Charles in Madison County, Ia., has offered to raise \$50,000 to secure the extension of the present Knoxville Branch westward to St. Charles. The distance from Knoxville to that place is about 60 miles, but for a part of that distance the track of the Winterset Branch could be used.

The people of Lucas County, Ia., are shortly to vote upon the question of levying a 5 per cent. tax in aid of the proposed extension of the Indianola Branch south by east to Chariton, about 25 miles.

#### Camden & Atlantic.

This company has bought a tract of 60 acres of wooded land adjoining the lake at Kirkwood, N. J., and will lay it out as a park, and erect convenient buildings for picnic and excursion parties.

#### New Castle & Franklin.

A meeting of stockholders was held recently in New Castle to consider plans for raising the money to meet about \$175,000 of floating debt obligations which mature this month. The net earnings of the road for last year were stated to be about \$23,000. It was resolved to sell bonds to the amount required and a committee was appointed to secure subscriptions.

#### Baltimore & Ohio.

The Baltimore *Gazette* says: "About two months since the Mount Clare shops of the Baltimore & Ohio Railroad discontinued the eight-hour system and commenced running on full time of ten hours. The change, however, has not materially benefited the workmen, as a deduction of 25 to 30 cents a day on all wages was then made. This arrangement enables the men to make from 10 to 15 cents more per day than under the previous eight-hour system. Laborers are paid from \$1 to \$1.10; machinists, \$1.90 to \$2.25; apprentice mechanics, \$1.25 to \$1.50, and foremen of shops, \$3.25 per day. About 1,200 men are now employed, about 50 per cent. of the capacity of the shops. Since 1872 the works have never had a full force of men employed. The greater part of the workmen live in the immediate neighborhood of the works, generally renting their houses, very few owning their dwellings. The work at present at the shops consists principally of repairs. Some eleven engines are being overhauled in the machine-shops, while a few



passenger and freight cars are being refitted and painted in the carpenter and paint-shops. The only work of construction being carried on is the building of about 300 freight cars. Work on these was commenced when the full-time system went into operation, and has been progressing since. From eight to ten cars are built per week. They are box-cars, and are designed principally for the carrying of grain. The Mount Clare works are the most extensive owned by the Baltimore & Ohio road, and are probably as complete as any in the country. The engine shops, when running a full number of hands, can turn out five locomotives per month."

#### Davenport & Northwestern.

The Iowa Supreme Court has granted a temporary injunction against the collection of the special tax of \$40,000 voted in aid of the extension of this road into the city of Davenport, Ia. The case, which will be tried soon, involves the constitutionality of the law under which the tax was voted.

#### Eastern Ohio.

This road now extends from Cumberland, O., northeast to Point Pleasant on the Marietta, Pittsburgh & Cleveland, seven miles. It is said that arrangements have been completed with the Baltimore & Ohio to extend it some eight miles further, to Campbell's, on that road.

#### St. Louis County.

This company has concluded a conditional contract with A. W. Alexander for the construction of its narrow-gauge road from the Union Depot in St. Louis westward about 11 miles. It will pass through Forest Park.

#### Montreal, Portland & Boston.

It is proposed to connect this road with the city of Montreal and the Quebec, Montreal, Ottawa & Occidental road by building a bridge across the south channel of the St. Lawrence from Longueuil to St. Helen's Island, and then running a steam ferry across the main channel to Montreal. Application is to be made to the Canadian Parliament for authority to build the bridge.

#### Measuring the Pacific Railroads.

The Secretary of War, Feb. 2, transmitted to the House of Representatives, as an answer to Mr. Jenks' resolution of Jan. 19, 1876, requesting a careful and exact survey of the distances on the Union Pacific and Central Pacific Railroads between Council Bluffs and Sacramento, the report of Capt. Twining, of the Engineer Corps, to whom this duty was assigned. This report shows that the length of each of these railways is somewhat greater than was shown by the original measurement upon which the subsidies were issued. The amount of the error is, for the Union Pacific one mile and a quarter, and for the Central Pacific a little less than a mile. The track has been changed in several places since the completion of the road in order to obtain a better location. These changes have been in every instance examined by the army engineers, who find that the change of length is immaterial, being only a few hundreds of feet. There had been a report that the length of the roads had been exaggerated, in order to increase the Government subsidy.

#### Auction Sales of Railroad Securities.

In New York, Jan. 31, at auction, Detroit & Milwaukee convertible bonds, brought 20; Spartanburg & Union bonds, guaranteed by the State of South Carolina, 36; Greenville & Columbia bonds, guaranteed, 37; not guaranteed, 38; Rome, Water-lawn & Ogdensburg stock, 16; Milwaukee & Horicon land bonds, one in 1882, \$11 per \$1,000 bond; Reading & Columbia first-mortgage bonds, 89%.

#### Atlantic & Great Western.

At a meeting of all classes of stock and bondholders held at the call of the reorganization trustees in London, Jan. 17, Mr. C. E. Lewis, of the trustees, stated that during the year since their last meeting the securities deposited with them had increased to more than two-thirds of the first-mortgage bonds, favorable decisions had been had in the claims for rental by the United States Rolling Stock Company, and a satisfactory arrangement had been made, for two and a half years at least, with the Ohio mortgage bondholders. The unsatisfactory earnings, due to the war of rates, was an obstacle to obtaining the capital needed for an early reorganization, and they had to get rid of some hostile legislation which stood in its way. He condemned the recent movement of James McHenry and others to have an election for a new board of directors. It had been said that those who did not join in the scheme of reorganization would be able to come in after the foreclosure, but the trustees' legal decree from America was different. The meeting passed the following resolutions unanimously:

"1. That the action of the trustees on the several matters stated in their printed report, dated January, 1877, is approved of by this meeting, and that they be requested to continue their efforts to carry out the scheme of arrangement as early as the condition of affairs in America will allow.

"2. That in the opinion of this meeting the trustees should give notice, fixing the 30th day of April as the last day for receiving bonds under the scheme, and that all who do not come in by that day may be excluded by the trustees except upon special terms.

"3. That this meeting has perfect confidence in General Deyereux, the Receiver and in the present board of directors, and cordially thanks both the Receiver and directors for the careful manner in which they have carried on in the face of great difficulties the affairs of this company; and

"4. That this meeting protests against the election of a new board of directors of the company until the provisions for the protection of the bondholders as to the exercise of the voting power shall have been properly carried out."

#### Montclair & Greenwood Lake.

A contract has been let to Mr. A. S. Parliament, of Arlington, N. J., for the grading of the proposed extension from the present terminus on Greenwood Lake northward near the shore of the lake to the New York State line, about five miles. Work is to be begun at once.

#### Canon City, Wet Mountain & Rosita.

A company by this name has been organized in Colorado to build a railroad from Canon City up Grape Creek to Wet Mountain valley and thence by the most practicable route to Rosita. This is the second project in the field for a line from Canon City to the San Juan mining region, but both companies are organized by the same parties.

#### Missouri Pacific.

It was recently stated that the United States Supreme Court had refused to issue a writ of *mandamus* to the Circuit Court to allow an appeal from the decree of foreclosure, thus virtually closing the litigation. The New York *Bulletin*, however, now states that the Supreme Court has granted a rule to show cause why the whole of the foreclosure proceedings should not be set aside.

#### Intercolonial.

The contract for the work on the new deep-water terminus at St. John, N. B., has been let to J. T. Kennedy, the contract price being \$174,000.

#### Louisville, Paducah & Southwestern.

The Main Line bondholders, who bought the property covered by their mortgage, have organized a new corporation, under the name of the Paducah & Elizabethtown Railroad Company. Their road consists of the original line of the old com-

pany, from Elizabethtown, Ky., west by south to Paducah, 181 miles. The new company took possession Feb. 1, and has already made arrangements with the Louisville & Nashville for interchange of business.

#### Syracuse & Chenango.

John J. Meldram, Sheriff of Onondaga County, N. Y., gives notice that he will sell this road at the Court House in Syracuse, N. Y., March 17, under a decree of foreclosure and sale granted on suit of the trustees under the first mortgage. The sale will be made in three parcels, as follows: 1. The real estate on Canal, Townsend, Brown and Smith streets, in Syracuse. 2. The road from the intersection of Canal and Lock streets, in Syracuse, to Earlville, 43 miles, and all the equipment except 20 freight cars. 3. So much of the road as is north of Canal and Lock streets, Syracuse, and 20 freight cars, numbered from 40 to 59, both inclusive.

The road was formerly the Syracuse & Chenango Valley and was sold subject to the first mortgage in 1873 and reorganized under the present name. By the last report there were \$1,142,550 first-mortgage bonds outstanding.

#### Central Pacific.

Recently the State Transportation Commissioners of California began suit to compel this company to comply with the new railroad law, which provides that the schedule of fares and freight rates in force Jan. 1, 1876, shall be filed, and that the rates so filed shall thereafter be the maximum rates allowed to be charged. The Central Pacific refused to comply, but did file, under protest, a schedule of rates to all points in California.

The Central Pacific has now filed its answer, which is, in brief, that the law is practically a violation of the contract implied in the original charter under which the company was formed; that the State has no right to regulate inter-State commerce, and that the road was really built under authority derived from Congress and not from the State, and is therefore not subject to regulation by the State.

The trial will thus involve the whole question of State supervision and control over the company, and its result is awaited with a good deal of interest in California. The case will, doubtless, be carried up eventually to the United States Supreme Court for final decision.

#### Painesville, Canton & Bridgeport.

Messrs. Weiss, Britton & Co., contractors for this road, whose address is at Allegheny City, Pa., ask for proposals for 2,800 tons of iron rails, 30 lbs. to the yard, to be delivered at Solon, O., on the Mahoning Division of the Atlantic & Great Western, in lots of 233 tons, at intervals during the year 1877.

#### Missouri, Kansas & Texas.

Lately two or three trains have been wrecked by obstructions on the track in the sparsely settled regions of Southern Kansas and the Indian Territory. The officers of the road believed that this had been done by an organized band for the purpose of robbing the trains, and, after a good deal of trouble, have succeeded in securing the arrest of two of the men concerned.

#### Chicago, Milwaukee & St. Paul.

This company has published the following statement for the year ending Dec. 31:

	1876.	1875.	Inc. or Dec.	P. c.
Gross earnings.....	\$8,054,171	\$8,255,743	Dec. \$201,572	2.4
Working expenses.....	4,953,324	5,170,353	Dec. 217,029	4.3
Net earnings.....	\$3,100,847	\$3,085,390	Inc. 15,457	0.5
Interest on debt.....	2,161,082	1,980,227	Inc. 180,855	9.1
Surplus.....	\$99,765	\$1,105,163	Dec. \$1,005,398	15.0

The working expenses were 61.50 per cent. of gross earnings in 1876, and 62.63 per cent. in 1875. From the surplus for 1876 \$53,000 was paid to sinking funds and \$429,607 for a dividend on preferred stock, leaving a balance of \$457,158.

#### Chicago, Burlington & Quincy.

The new issue of 5 per cent. sinking fund bonds has been awarded to Morton, Bliss & Co., of New York, and Lee, Higginson & Co., of Boston, at \$875.05 per \$1,000 bond. This is the loan made to pay for the St. Louis, Rock Island & Chicago road and to put that line in good condition. It is secured by deposit with the trustees of an equal amount of 7 per cent. bonds secured by mortgage on the newly-acquired road, the excess of interest to be applied as a sinking fund. The two banking firms are now offering the bonds for sale in small lots at 89.

#### Lake Shore & Michigan Southern.

The New York Supreme Court has denied the application of Rufus Hatch and others for a writ of *mandamus* to compel the exhibition to them of the stock book of the company. The Court asserts its power to issue the writ, but does not believe that the applicants have shown any sufficient reason for its issue on the present occasion.

#### Port Royal.

An officer of this road sends us the following as to the present position of the road: "The sale of the road on Dec. 8 last was postponed, as the Trust Company failed to get an order from the Georgia United States Court similar to that of the District Court for South Carolina ordering foreclosure and sale. That order has now been obtained, but, owing to the Court in South Carolina withholding its decision on the application of an outsider to be made a party to the proceedings, no other time has now been fixed."

The outsider referred to is the Georgia Railroad Company, which recently petitioned to be made a party to the suit on account of its guarantee of certain of the bonds.

#### The Freight Competition in 1876.

[From the Eighth Annual Report of the Massachusetts Railroad Commissioners.]

In the last annual report of this Board, a somewhat detailed account was given of the severe competition among the through east and west lines which had existed during a large portion of the year 1875, under the influence of which rates were reduced to a point lower than had ever before been known. In December of that year, at the time the report in question was prepared, a combination among the through lines had been at last effected, and it was understood that the war of rates was to cease. The difficulty had arisen between the Grand Trunk line and its eastern connections, to and from competing points in New England on the one side, and the Boston & Albany and New York Central on the other. It thus, as did not require to be pointed out, affected the interests of Boston more immediately than those of any other city in the country, though the struggle involved the whole question of through rates. The settlement usual in such cases was finally effected—the more direct line agreeing to a division of through business with the less direct, based upon a rule of apportionment which was supposed to secure to each a fair share of the business; in this case the through business was divided on the basis of the amount of it done by each line during the two previous years. In other words, the business was practically "pooled," a fixed schedule of rates was agreed upon, and competition ceased. At the time, the members of this Board expressed the opinion that this arrangement in no way touched the root of the difficulty, and that it would prove to be merely temporary. This speedily proved to be the case.

The combination of December, 1875, was, in fact, of even shorter duration than any of its numerous predecessors, for it lasted scarcely one month. On the 7th of February, it was

broken in consequence of a misunderstanding between the Erie and New York Central railroads, and a new war of rates was begun on all east-bound through freights, under the influence of which they fell rapidly. This continued until the 2d of March, when another meeting of the representatives of through lines was held, and renewed efforts were made to bring about a combination. These, however, resulted in nothing, except a brief postponement of an inevitable struggle. They wholly failed to touch the real root of the difficulty. This no longer lay in the old and chronic inability of the railroad officials to put any trust in each other's good faith, and rigidly to enforce a scrupulous regard to agreements upon their subordinates. The struggle had assumed a new, and, to the railroad interests, far more dangerous form, that of a bitter rivalry between the great commercial cities of the seaboard. Baltimore and Philadelphia were not only asserting an ability to compete with New York City as exporting points for Western produce, but owing to the thorough organization and perfect development of their great through railroad lines, they were demonstrating their power to do it. Ever since the opening of the Erie Canal in 1825, a monopoly of the business of exporting produce had been practically conceded to New York. As is very well known, until within the last ten years it was not supposed that railroads could compete for the carriage of cheap and bulky articles, with lake or even slack-water navigation. Rates, however, have generally fallen, until it has at last been demonstrated that under certain favorable conditions it is more advantageous at all seasons to forward nearly every description of merchandise by rail than by water. Accordingly, the amount of agricultural products moved by rail from west to east, as compared with that moved by water, has gradually risen until at the close of navigation (Dec. 2) of the year just ended, it amounted to more than half of the whole quantity moved. In 1873, the proportion was 29.8 per cent. moved by rail to 70.2 per cent. by water; in 1874, it was 33 per cent. by rail to 67 per cent. by water; in 1875, it was 41 per cent. by rail to 59 per cent. by water; and at last, in 1876, it was 52.6 per cent. by rail to 47.4 per cent. by water. This transfer, also, had taken place notwithstanding the fact that during the years named the pressure of competition had forced down rates on wheat carried by lake and canal from Chicago to New York by more than one half, from 19.2 cents per bushel to 9.5. Lower than this they could not go, and at this rate the railroads were taking the traffic. Under these circumstances, it was inevitable that a wholly new phase of competition must be developed. Canal navigation was possible to New York alone; but when the traffic passed from the canal to the railroads, other cities possessed equal if not superior advantages. Accordingly, the struggle was no longer between the railroads leading to New York and the Erie Canal, but between railroads leading to different seaboard points. The monopoly of New York was threatened. Neither was the result of the impending struggle by any means so certain, as long habit might induce many people to suppose. The prescriptive enjoyment of an undisputed monopoly has produced in the case of New York City the usual results, and both railroads and business community of that place, confidently relying on long possession and natural advantages, had allowed abuses to creep in, or failed to supply improved facilities, until the handling of produce for export there was made most unnecessarily expensive. Meanwhile, the cities of Philadelphia and Baltimore having great natural disadvantages to overcome, were naturally forced to husband every resource and make the most of every circumstance in their favor. All this they did with a degree of sagacity, foresight and success well deserving the careful study of other and more favorably located communities. To Massachusetts, and the city of Boston especially, their experience is very suggestive. The policy pursued by Massachusetts and Boston, during the last twenty years of great railroad development, has been in fact the direct opposite of that pursued by Pennsylvania and Philadelphia, or by Maryland and Baltimore. Not only, also, has it been the direct opposite, but it still continues to be so. In the case of the two last-named communities, the fundamental principle of their through railroad development has been a complete and thorough concentration of force,—the idea of local competition in through business received no favor. It seemed to be instinctively appreciated that the struggle was not between rival lines leading to Baltimore or to Philadelphia, but between single thoroughly developed lines leading to those cities and other lines leading to New York. Accordingly, the whole resources of the two communities were, under the direction of very able men, devoted to the complete development of these single lines. Meanwhile, in Massachusetts, during the early period, the Boston & Albany, then known as the Western Railroad, had been in great degree built up by the aid of the State, exactly as the Pennsylvania and the Baltimore & Ohio had been. Had the same policy of concentration been subsequently pursued, it would have led to the complete and thorough development of that line, without any regard to local competition, and to the securing by it at the proper time of the connecting roads necessary to give to Massachusetts and to Boston an independent all-rail route to the West. This would have been perfectly feasible, down to a time as late even as the year 1868. The New York Central and the Lake Shore & Michigan Southern Lines might have been made just as much a part of the Boston & Albany road as the Pittsburgh, Fort Wayne & Chicago is a part of the Pennsylvania road, or its Chicago extension is part of the Baltimore & Ohio. Most unfortunately, a theory of railroad development, natural perhaps, and reasonable enough in the early and experimental days of the system, but long since abandoned elsewhere, still held possession of the public mind of Massachusetts; and, indeed, seems even yet to retain its influence over it. This community wholly failed to realize that the final struggle was to be between concentrated lines to rival cities, and rested in the firm conviction that it would always continue to be one between rival lines to the same city. Accordingly, while New York, Philadelphia and Baltimore were stretching out to all the great centres of the West, the business vision of Boston seemed limited to the mouth of the Erie Canal at Albany, or at the farthest to the eastern extremity of Lake Ontario. Instead, therefore, of concentrating the hopes and resources of the community on the complete development of one great through line, the public attention was dissipated and the public funds were sunk in such hazardous enterprises as the Hoosac Tunnel and the Boston, Hartford & Erie Railroad. Now that the railroad system has more fully developed itself, the unfortunate consequences of this mistaken policy have become at once obvious and irreparable. That policy, however, is still clung to, though rather it would seem from a popular inability to adopt any other and more positive line of action than from any particular faith in it. The "toll-gate system," so called, as applied to the Hoosac Tunnel line, is the last illustration of a theory of railroad development now utterly abandoned outside of the limits of Massachusetts—the theory that a community in the struggle for through business with other communities will derive more benefit from a weak competition between a number of undeveloped and incomplete railroad lines than from the action of a single powerful and concentrated one.

Meanwhile, it was the natural outcome of the other policy in the changed relative position of Baltimore and Philadelphia towards New York which, during the early months of 1876, was gradually driving the great lines into a fiercer and more destructive war of rates than had ever been known before. New York City, and consequently the main railroad line leading to it, began for the first time to realize that its easy supremacy no longer existed, and that in the struggle of competition it had no advantages to waste. Therefore it had always been the



practice on shipments from Western points to the seaboard to take into consideration the distances of the several cities from the point of starting. A concession had always been allowed in favor of the southern points of shipment, under which originally the rate to Boston had been five cents per hundred more than to New York, that to New York five cents more than to Philadelphia, and that to Philadelphia five cents more than to Baltimore. These differences had subsequently been modified until, for some time previous to March, 1875, on all export merchandise, rates to Boston and New York were equal, while those to Philadelphia and Baltimore, though equal to each other, were five cents less than the New York-Boston rate. As the sense of pressure from the competition of the more southern thoroughfares increased, however, the New York interest began to realize that this arbitrary rate placed them under a too heavy disadvantage. Accordingly, a new adjustment of rates was effected on a different principle. A differential tariff was arrived at, based on distance, under which, taking Chicago as a fixed point and the rate from that city to New York as the standard, a reduction from it of 10 per cent. was allowed in favor of Philadelphia, and one of 12.5 per cent. in favor of Baltimore. The position of Boston was not affected by this arrangement; the old contract being still adhered to, under which, through a rebate in case of export, foreign shipments were made from Boston on the same terms as from New York.

In its practical operation this new system, based as it was on distance in miles to the seaboard, proved highly advantageous to the southern lines. While the difference in their favor was 10 and 13 per cent. from Chicago, from other points it was much larger, until in the case of Cincinnati and Baltimore it became no less than 24 per cent. The effect of this soon became apparent in the largely increased receipts of produce at Philadelphia and at Baltimore, indicating an alarming diversion of the export trade from New York; for the difference in rates between the ports was not infrequently almost equal to the entire ocean freight to Europe. When those controlling the New York Central road became fully awake to this fact, and when they also realized the pressure in the way of equal competition under any circumstances which Baltimore and Philadelphia, with all their perfect facilities for handling through business, could now bring to bear upon them, it naturally occurred to them that the time had come for refusing longer to concede a differential rate in favor of those who seemed in no respect less advantageously placed than themselves. In order, however, to assume a consistent position on the subject, it became necessary for the Central road to extend the principle beyond New York, and to claim a uniform rate from the interior to all the seaboard points. This principle it was perfectly obvious that the southern or shorter routes would only concede under a sense of absolute compulsion. A full trial of strength thus became inevitable.

The struggle did not, however, break out in the first place between those who subsequently became the principal parties to it. On the contrary, all through the month of March and the early part of April last, conferences were held and strenuous efforts made to hold the through lines to an understanding among themselves. At the last of these, on the 4th of April, the New York Central represented that it was under the necessity of meeting the competition of the Grand Trunk in New England, and to this those representing the other lines assented upon the understanding that this struggle was to be a local one, and was not to extend to New York, or to divert business from that city. In the course, however, of a very few days, it became apparent that the contest could not be thus restricted, and as the result of a final conference on the 18th of April, at which a number of complaints were presented, the New York Central finally gave notice of the complete abandonment of all agreements, and almost immediately a general war of rates began. Between the 3d of May and the 14th of June, the fare between Boston and Chicago over the New York Central fell from \$25.85 to \$14, and that over the Grand Trunk from \$23.85 to \$12.50; while as respects freights, the rates between Boston and Chicago on articles of the first class fell from 75 cents per hundred pounds to 20 cents, and those on agricultural products from Chicago to New York fell from 50 cents per hundred to 18 cents. These, also, were the public rates, while innumerable special contracts on terms far more favorable to shippers were made wherever business was competed for. Shippers whose patronage was really worth having were, in fact, in a position to dictate their own terms; and they did it. For six months the spectacle was witnessed of railroads hauling merchandise 1,013 miles east for \$3.60 per ton, and the same distance west for \$2.80 per ton—in the one case at the rate of 3.5 mills per ton per mile, and in the other at the rate of 2.8 mills; a result which made sober and reasonable the most extravagant predictions which the advocates of cheap transportation had ever ventured to utter.

No sooner was the struggle fairly developed than the true issue was boldly avowed by the New York Central—it being to restore the commercial supremacy of New York, imperiled by the rapid development of southern rivals. As a natural result of the mistaken railroad policy which has been described, Boston counted for nothing in the struggle—controlling only locally competing lines, and no single consolidated through line, it was in no position to assert itself, or to defend its own interests. Yet, in fact, the interests of Boston as a commercial point were more deeply involved in the issue of the struggle than those of any other city; for the mileage charge, if persisted in, could only result in transferring the whole business of exporting produce from the northern to the more southern points. Fortunately, on this point, as between New York on one side and Philadelphia and Baltimore on the other, the interests of New York were identical with those of Boston. The issue was a simple one. It was conceded on all sides that in the case of rival or competing lines between any two given points, as Chicago and New York, the shorter or more direct route had the right, as it was termed, to establish the rate; that is, it fixed a rate, and the longer routes were obliged to meet it, regardless of their own greater mileage, the principle of charging so much per ton per mile being, for obvious reasons, inapplicable. Where, however, lines terminated at different though competing centres, it was maintained that the principle of mileage charge should apply,—that there was no reason, for instance, why Baltimore should not enjoy, as compared with Portland or Boston, the full advantage of its geographical position. If conceded, this principle could have practically resulted in but one thing: whenever railroads could obtain paying rates, the volume of produce seeking export would have gone irresistibly to the nearer or more southern ports; whenever, on the contrary, rates were very low, the tendency would have been towards the northern ports. This necessarily came from the fact that upon a high or 50-cent-per-hundred rate, with a mileage difference of 10 per cent. in favor of the more southern port, the charge to that port would be as much as 5 cents a hundred less than to the more northern port, which would be sufficient, as experience had shown, to draw the business almost exclusively into that channel. If, on the other hand, rates became very low, falling to 15 cents a hundred, then the difference in favor of the southern points would be but 1.5 cents, and this might very possibly not prove a sufficient inducement to divert the course of trade from its natural outlets through the northern ports. While the managers of the Baltimore & Ohio and the Pennsylvania roads insisted, therefore, on the differential allowance, those of the New York Central met them by fixing rates at so low a point that the differential allowance, when insisted upon, could not amount to enough to influence the course of traffic. It is not yet apparent, so far as the railroads are concerned, what the effect of the process involved in carrying out this method of warfare has been. Before the substitution of steel rails for

iron, the roads could not possibly have endured the test. As it was, some idea may be realized of the wonderful economy which has been attained in the movement of merchandise, from the fact that as a regular thing a ton in weight was moved 450 miles from Buffalo to New York for \$1.50, whereas in the early part of the century it would have cost \$100. Meanwhile, there is some reason to suppose that under certain favorable conditions the transportation of freight even at this rate is not unremunerative to the companies concerned in it. Indeed, judging by their published reports while the recent struggle was going on, it might not unfairly be inferred that throughout it the trunk lines were realizing a quite satisfactory profit on their entire business. Naturally, however, each of the leading competitors then felt obliged to insist that it was suffering least of all, and was, indeed, in a position to continue the struggle indefinitely. Accordingly, they none of them reduced their rates of dividend. In point of fact, however, there can be little doubt that the resources of all, even the strongest of the railroad companies, were heavily strained in carrying on the struggle, while many of the smaller and weaker ones were driven to actual bankruptcy.

Having practically lasted for over eight months, the struggle has been brought to a close while this report is passing through the press (Dec. 16). Of the arrangement arrived at, and of its bearing on the interests of the several seaboard points, it would, therefore, be somewhat premature to now venture an opinion. It was based on two distinct principles. A differential rate, computed on mileage distance, was conceded to the southern lines on all shipments from the West to the seaboard for home consumption, while equal rates were to be allowed on all foreign shipments wholly irrespective of the port through which they were made. If, for instance, a car-load of wheat was shipped at Chicago or St. Louis for Baltimore and no further, it was to be carried at a rate of 13 per cent. in the one case and 14 per cent. in the other; less than if it were shipped to New York. If, however, the car-load was originally shipped to Liverpool, it was to be at the same rate for the entire distance, whether it went through New York or through Baltimore; and if, having reached Baltimore or New York at the local rate, it was then shipped to Liverpool, such rebates were to be allowed as would equalize the several ports. As respected local rates, so called, the simple difference between this arrangement and the one which preceded the conflict was, that the excessive difference in favor of Philadelphia and Baltimore on shipments from points south of Chicago was fixed at one given percentage. Under the previous arrangement this had varied from 14 per cent. reduction from the New York rate in the case of St. Louis shipments to Baltimore to 24 per cent. reduction on shipments to the same place from Cincinnati. In place of this, two points and two corresponding differential rates were now fixed—a concession of 10 per cent. from the Chicago-New York rate was made in favor of Philadelphia, and 13 per cent. in favor of Baltimore on all Chicago shipments; and another allowance of 9 per cent. in favor of Philadelphia, and 14 per cent. in favor of Baltimore, on all St. Louis, Indianapolis and Cincinnati shipments. The new basis of agreement seems, in fact, designed to secure equality on foreign shipments to all the exporting points, while on local shipments a slight advantage is given to New York in the northern part of the great district in which all the trunk lines compete, and a larger advantage is given to Baltimore in the southern part of that district. Boston, for the reasons already stated, necessarily shares in a fixed proportion of the advantages or disadvantages which ensue under the practical working of the arrangement to New York.

The chief objection to the arrangement is an obvious one. It apparently settles nothing. In operation it cannot but be found too complicated to admit of the parties long abiding by it. The absolute want of faith and of confidence in each other which has hitherto marked the proceedings of those managing the great trunk lines, cannot but find ample field for development in the practical working of a system so intricate. The question of rebates on ocean shipments will admit of infinite wrangling. Apparently, in order to arrive at a decision in each case, it will be necessary to ascertain not only the ocean rate actually paid on that particular shipment, but also what was the rate on the same day to the same destination from the other ports. Practically, such questions, arising the whole time, must prove impossible of decision except by the dictum of some common tribunal, for which no provision is made. This combination, therefore, like the many which have preceded it, lacks, so far as can be judged, the elements essential to its permanence. There is no one either authorized or competent to keep the peace between the high contracting parties. Each reserves the right to construe the agreement to suit itself, and to refuse obedience to the decision of any one else. There is neither a court of common arbitration, nor, even if there was, do the contracting parties show any disposition to put themselves under sufficient bonds to insure their acquiescence in its decisions. Without this, all railroad combinations in this country, where a division of territory is impracticable, will prove but temporary. Even were they, under certain conditions, practicable, they are not so now, owing to the fact that the whole complicated system under which through or competitive railroad business is done is curiously vicious and extravagant, and must be radically reformed as a preliminary to any final settlement. It now implies the existence of a vast army of subordinates whose very existence depends on that not being done which those controlling the lines which feed them are continually trying to do. To realize the truth of this fact, it is but necessary for any person to walk down the leading business streets of any considerable town in the country. He will see that a great number of expensive offices bear the signs of railroad companies and of car and dispatch lines, and at them tickets can be purchased and rates of freight made which are binding on all the companies included. The rents, salaries and perquisites of this army of retainers all come out of the railroad corporations, and the interests of the retainers and the corporations are exactly antagonistic—the first are always working to bring about railroad wars, in which business with them is brisk, while the last are always striving to effect combinations.

As long as this state of affairs continues, periodic railroad wars will continue. The hopes of stockholders and the fears of the business public in regard to their ceasing will be equally disappointed. A conference of those controlling the trunk lines which began its labors by clearing away the whole complicated machinery through which competitive business is fought over and secured, and then completed them by establishing a common board of arbitration over points of dispute, clothed with a real executive power—such a conference might result in something. For this, however, no one seems as yet to be ready, and the trials of strength must, therefore, continue. Meanwhile, each year the results of the attempts at combination become weaker and verge more nearly on the ludicrous, while the wars become longer and sharper and the resulting rates permanently lower. It is not probable, however, that the recent conflict will be immediately renewed. The severe losses and bitter experience of the last few months will not be forgotten at once, and for a time matters of dispute will remain unsettled, and breaches of compact will pass unnoticed. Meanwhile, so far as the railroad system of the whole country is concerned, it is necessary to bear in mind that these continually renewed struggles between the great continental and competing trunk lines are but incidents in a phase of the process of development. The railroad interest of the country is consolidating, and it is doing it through the survivorship of the strongest. Each new war of rates is made more severe than that which preceded it, and the

weaker corporations find themselves continually nearer the end of their resources, and less able to sustain the pressure. As they succumb under it, they are absorbed through bankruptcy by the yet solvent lines as fast as these see their advantage in absorbing them. Competition is, therefore, as rapidly as possible resulting in consolidation, and this process seems likely to continue indefinitely through the immediate future. What shape this consolidation will ultimately assume, in another and later phase of development, it is futile now to consider.

Returning, therefore, to the combination of Dec. 16, and its probable effect on the interests of Massachusetts and of Boston, the members of this Board see no reason to modify the conclusions they have heretofore expressed. There seems to be no real ground for apprehending local disadvantage from any railroad combination which has been or is likely to be effected. On this subject they, a year ago, expressed themselves as follows: "However it may be under exceptional circumstances and for brief periods, in the long run active competition between the through routes cannot but be prejudicial to Massachusetts' interests. It leads directly to discrimination in favor of rival communities. It does so for the obvious reasons that, as a rule, railroad competition is and must continue to be stronger to New York and other seaboard points than to Boston."

"In the struggle of competition, therefore, Boston stands in a poorer position to protect itself than any other seaboard city. In the long run, the discrimination will surely be against it, in the future as in the past."

"It would seem, therefore, to be the true policy of this section to encourage, rather than to discourage, a general public combination of the through railroad routes, based on principles of equality and stability. The law of the strongest does not work in our favor, and we cannot permanently steal business. Before a permanent combination is arrived at, however, there are certain principles the concession of which, as a part of the accepted policy of any general railroad system, is essential. Foremost among these is the absolute equality of the Atlantic seaboard centres as respects the movement of merchandise to and from certain great distributing points of the West."

It has been seen that, in this last essential respect, the result arrived at on Dec. 16 is in the nature of a compromise—the principle of equal rates on produce for export being conceded to the one hand, while for local business a differential rate is conceded on the other. The final solution of the controversy between the great through lines is, however, yet to be arrived at. This compromise, however, is most unlikely to prove a final solution of the controversies between the great through lines, for the simple reason that it must, apparently in practice, work adversely to some of them. New York is not yet ready to see its commercial supremacy pass away from it, nor will Philadelphia and Baltimore quietly surrender the commercial advantages they have so hardily won. But the experience of the last few years would seem to warrant a conclusion that New York, in this matter, can no longer afford to concede anything—that those having charge of the interests of that city must insist on absolute seaboard equality. In that case, the present truce is simply to permit the trial of an experiment, the result of which will be a renewal of hostilities over the old issue. Did Massachusetts and Boston possess an independent line, which could be wielded exclusively in their interests, they would unquestionably be strongly disposed to insist on the full enjoyment of all the great natural and geographical advantages of their city, as a recognized part of any permanent settlement. Under the circumstances, however, they are wholly dependent on such chance and suicidal competition as the Grand Trunk Railway may be disposed to wage with its more powerful and direct rivals. This in the future is unlikely to prove so active an element in the problem as in the past. The Grand Trunk, being financially the weakest of the through lines, has apparently suffered in the recent conflict much the most severely of them all, and a continuance of it would not improbably result in plunging that company more deeply than at present into bankruptcy. Its connections, also, in New England have felt the strain very severely, and have neither the means nor the disposition to endure it longer.

Finally, the present situation and the conclusions which may apparently with some degree of confidence be deduced from it, can be briefly summed up as follows: As respects what is known as through business, the period of active railroad competition has of late entered on a new phase—that of competition between rival termini instead of between rival lines to the same terminus. In the course of this struggle, so far as Massachusetts and Boston are concerned, an equality of advantages with other localities seems to be secured through a community of their interests with those of New York, and it must depend upon our local railroads, and especially the business community to afford such facilities of handling and of transit as will constitute an inducement to traffic to seek this channel. The vital advantage of an independent thoroughfare, on which the whole future of Philadelphia and Baltimore seems to so great a degree to depend, is lost to Boston, and under present circumstances it is very difficult to see how it can be recovered. Indeed, the true policy for this community to adopt would not seem to dictate even an endeavor to recover it, for it is useless to attempt at certain stages of development to abandon a long-established plan and to adopt a new one, as it is to stand still and repine over lost opportunities. Good or bad, the policy of Massachusetts as respects its through railroad connections has been adopted, and more than twenty years of time and twenty millions of the public money have been expended in the attempt to carry it out. It only remains to be seen logically, with as much foresight and at as little outlay as possible. To bring anything to pass, however, a definite plan is essential; not only must there be a distinct end in view, but all efforts must be concentrated on the attainment of that end. Now, the fundamental idea of the recent Massachusetts policy has been local railroad competition—the same local competition whether to the Hoosac Tunnel "toll-gate," or to Albany or to Ogdensburg. The horizon has always been a limited one, proper to the conditions which existed a quarter of a century ago. To bring anything about, it must be extended. The results accomplished in their own interests by other communities should, so far as possible, be appropriated for New England. A local competition must give place to a continental competition—the bounds must be transferred from the Hudson to the Mississippi. This can now only be done by drawing the great thoroughfares to the other seaboard cities into New England. The Hoosac Tunnel, instead of being a "toll-gate," must become part of a trunk line, and that trunk line, instead of competing at Albany with the Boston & Albany for the traffic which flows over the New York Central, must be extended to the interior, bringing to us the whole competing force of the Erie and the Pennsylvania, and even the Baltimore & Ohio. This subject, however, has already been discussed in a previous Legislature, and, as it more especially relates to the best way in which that line can be utilized, its further discussion at this time would seem to belong rather to those to whom the management of the tunnel "toll-gate" is at present entrusted than to the members of this Board.

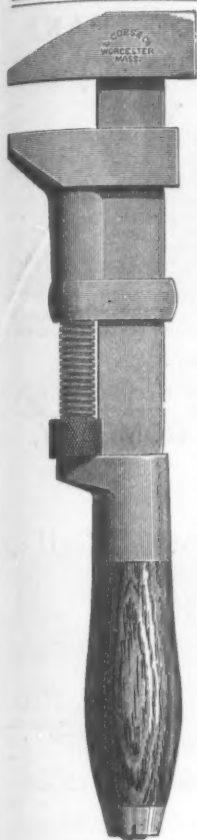
CHAS. F. ADAMS, JR.,  
A. D. BRIGGS,  
FRANCIS M. JOHNSON,  
Railroad Commissioners.

BOSTON, Dec. 21, 1876.

† Seventh Annual Report [1876], pp. 68-9.

‡ Report of the Corporation of the Boston, Hoosac Tunnel & Western Railroad Company, Leg. Doc's, 1875, House, No. 9.





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GENUINE IMPROVED PATENT

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MANUFACTURED BY  
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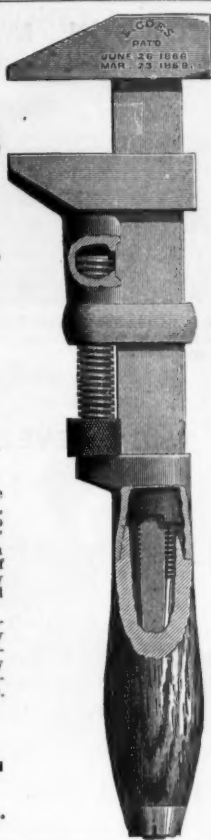


We invite the particular attention of the trade to our New Straight Bar Wrench, widened, full size of the larger part of the so called Landsay's "REINFORCED OR JOG BAR." Also our enlarged jaw, made with ribs on the inside having a full bearing on front of bar (see sectional view), making the jaw fully equal to any strain the bar may be subjected to.

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Cleveland, O., March 1, 1876.

IRON CLAD PAINT CO., Cleveland, O.

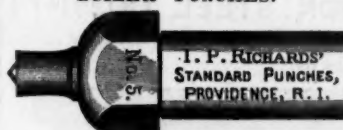
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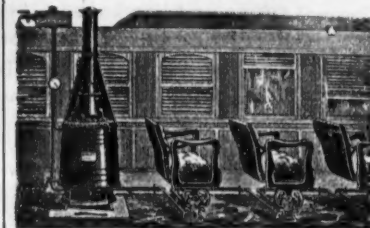
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## THE ASHTABULA BRIDGE DISASTER.

OFFICIAL REPORT OF THE PROCEEDINGS OF THE CORONER'S JURY IN THE CASE.

As soon as practicable after the closing of the official investigation of the Ashtabula Bridge accident, the Official Report of the Proceedings of the Coroner's Jury now sitting at Ashtabula, Ohio, will be published, edited by J. M. Goodwin, C. E., M. Am. Soc. C. E., who has acted as expert and associate counsel for the jury.

The Proceedings will be printed from certified transcripts from the notes of the stenographer to the jury, and will be a complete record of the investigation. The book will be royal octavo, page 63, 10 1/2, long primer, leaded. It will have, probably, about 450 pp., and will contain Maps of the village of Ashtabula, and of the Station Grounds of the L. S. & M. S. Ry., at Ashtabula; view from photograph, of the Bridge as it was before the disaster; the original design of the bridge; drawings, general and in detail, of the bridge as constructed; several strain-sheets prepared by engineers, witnesses before the jury; and a diagram showing the wreck of the bridge and train.

Several eminent bridge engineers have, after careful examination of the wreck of the bridge, testified before the jury and have submitted written statements, which statements and the evidence in full will appear in the Proceedings. Mr. J. Tomlinson, C. E., of Ottawa, Canada, has also given testimony in the case, and Charles Hilton, C. E., of New York, will also appear as a witness.

The price of the book will be announced as soon as its cost can be determined. Orders may be sent to the Railroad Gazette, 73 Broadway, New York, or to J. M. GOODWIN, Room 12, Chamberlain Building, Cleveland, Ohio.

C. A. HOTCHKISS.

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HAMMERED STEEL RAILS

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AND STEEL FORGINGS.



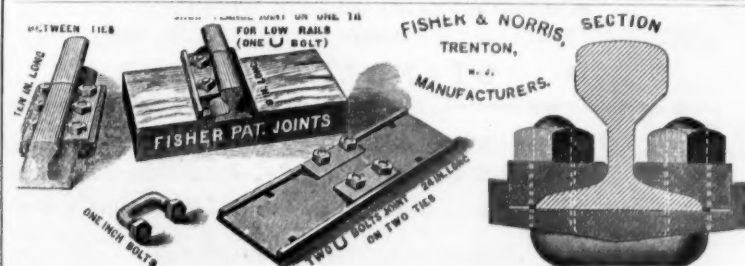
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JOHN F. BARKER, Secretary.

HENRY C. SPACKMAN, Treasurer.

L. S. BENT, Superintendent.  
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## THE EDGAR THOMSON STEEL CO., LIMITED, MANUFACTURERS OF



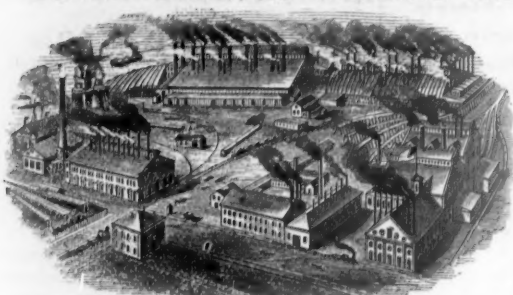
General Office and Works at Bessemer Station (Penn. R.R.), Allegheny County, Pa.

New York Office, No. 57 Broadway.

The members of the Edgar Thomson Steel Company, Limited, have had large experience in manufacturing and in railway management; their works are the most complete in the world, with all the late improvements, and are located in the best Bessemer metal district in the United States, and their managing officers are experienced in the manufacture of Bessemer Steel. The Company warrants its rails equal in quality to any manufactured in the United States. Rails of any weight or section furnished on short notice. Orders for trial lots solicited.

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AND  
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Incorporated - - 1869.  
CAPITAL, \$3,000,000.

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Of any Weight not Less than 30 lbs. per yd.

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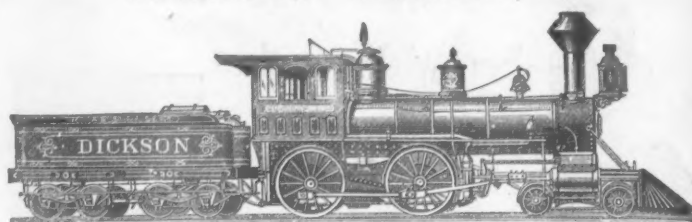
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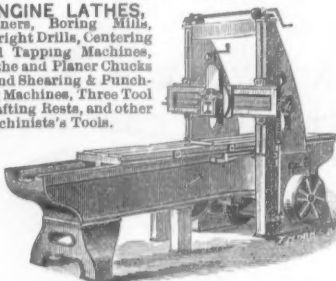
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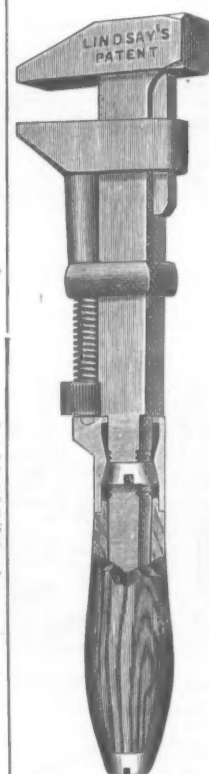
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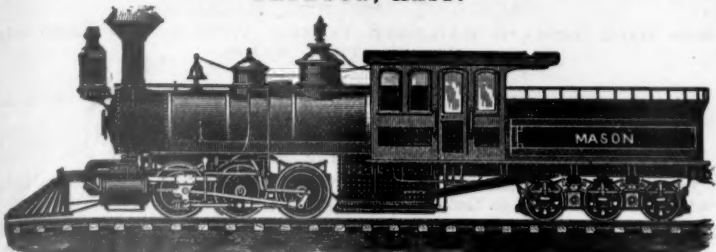


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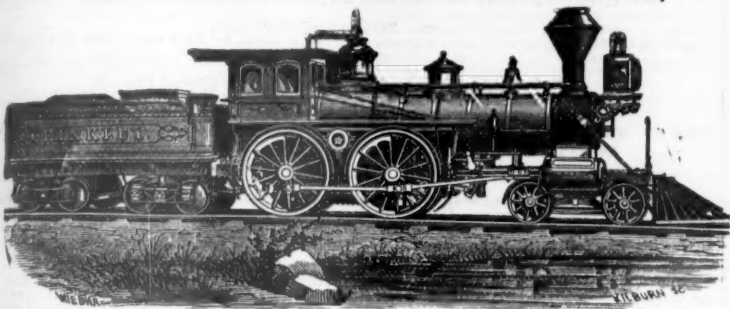
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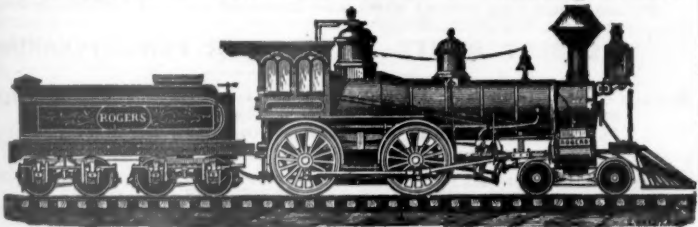
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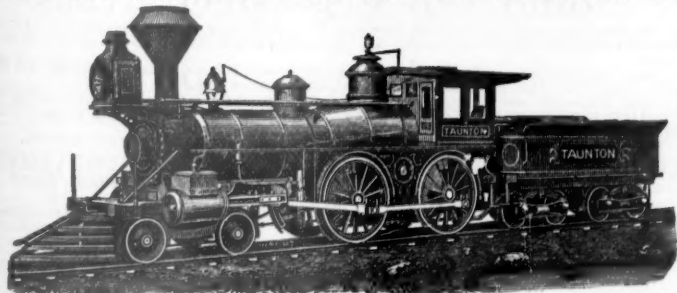


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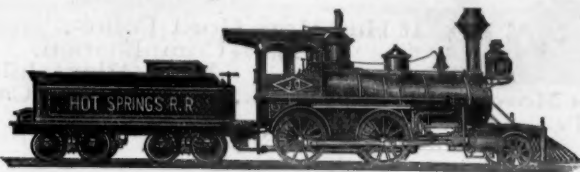
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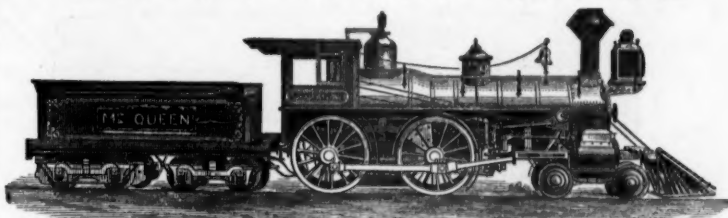
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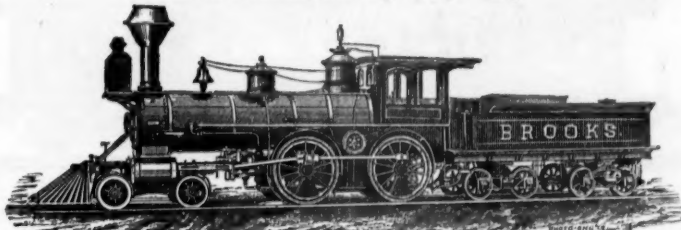
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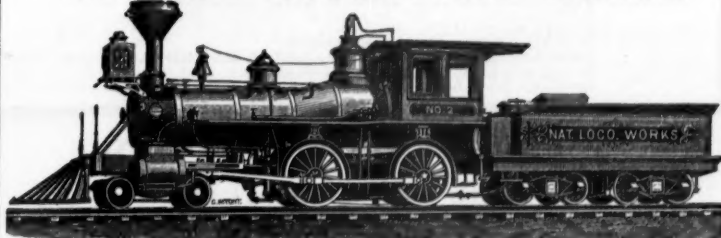


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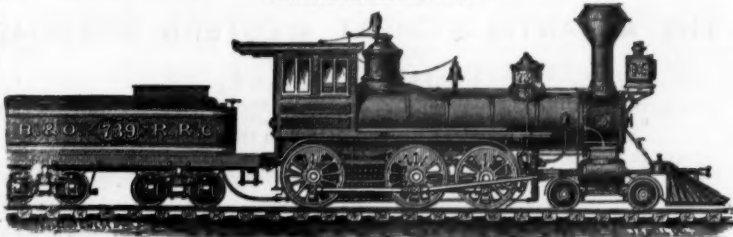


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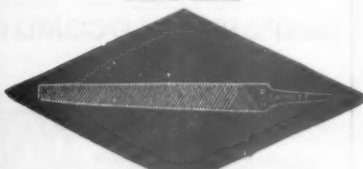
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forms the Great Broad-Gauge Route to the WEST and SOUTH. For Chicago, Cleveland, Omaha and all points in the Northwest. For Cincinnati, Louisville, St. Louis, Kansas City and points in the Southwest.

THIS IS THE ONLY LINE, in connection with the Erie Railway, which runs through sleeping coaches from New York and local stations to Chicago, Cleveland, Mansfield, Gallon, Dayton and Cincinnati without change.

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Wagner Palace Sleeping and Drawing Room Cars Attached to All Trains.

Through cars New York and Boston to Buffalo, Niagara Falls, Cleveland, Toledo, Detroit, Chicago, Indianapolis, Louisville and St. Louis, &c. No extra charge via Niagara Falls.

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FAST TIME, SURE CONNECTIONS, PARLOR AND SLEEPING CARS.  
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This is the only line making direct connection with all the Principal Trunk Lines of the East for NASHVILLE, MEMPHIS, NEW ORLEANS and all points in Texas, either by way of LOUISVILLE or ST. LOUIS.

Direct connection at ST. LOUIS for all Railway Towns in Kansas, Nebraska and Colorado.

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THE ONLY DIRECT ALL RAIL ROUTE; being 224 miles the Shortest Route.

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Five Hours the Quickest Route to Denver.

Close connections made at Cheyenne with Denver Pacific Railway. At Denver with the Colorado Central. At Golden City with Daily Coaches for the Mines. At Denver with Denver & Rio Grande Railway for all points in Southern Colorado, New Mexico and Arizona.

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THE EMPIRE TRANSPORTATION COMPANY OFFERS TO THE BUSINESS COMMUNITY A  
RELIABLE FAST FREIGHT LINE BETWEEN THE EAST AND THE WEST AND THE  
GREAT OIL REGION OF PENNSYLVANIA.

Via the Philadelphia & Erie Railroad and its Connections.

IT OWNS AND CONTROLS ALL THE CARS OF ITS LINE, which are new and built expressly for its trade, and furnished with BROAD TREAD WHEELS, which enable it to run through irrespective of change of gauge, thus avoiding the injurious delays prevalent at transshipping points.

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1 p. m. for Washington, Pittsburgh, Cincinnati, Chicago, and for Richmond, via Gordonsville. Pullman cars from New York to Baltimore and Washington. 3 p. m. daily for Washington, the South and West. Pullman's sleepers from New York to Baltimore and Washington, making close connections for Chicago, Cincinnati, Louisville, St. Louis, Pittsburgh, the South and Southwest. Connect at Washington with trains for Lynchburg, Florida, New Orleans and the South. For through tickets please call at Company's offices, 315 and 1,238 Broadway, New York; and at the ticket offices, foot of Cortlandt and Desbrosses streets; and Depot, Jersey City. ASK FOR TICKETS VIA BALTIMORE &amp; OHIO RAILROAD.

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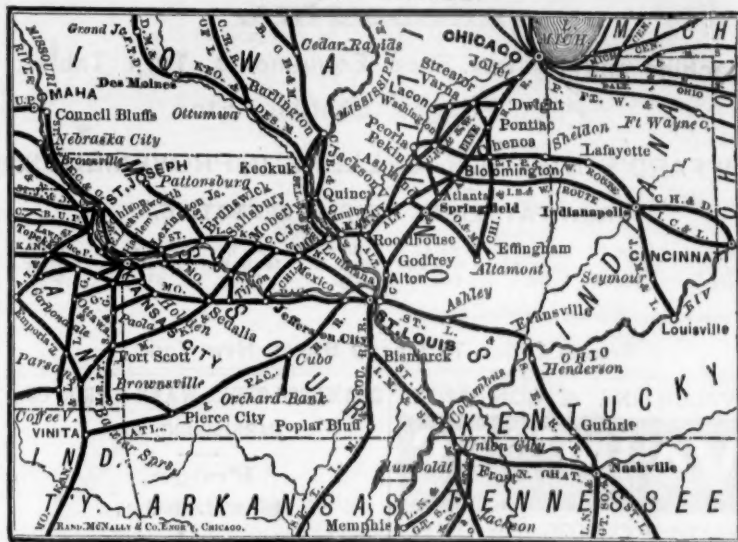
For Through Tickets and all desired information in regard to Rates, Routes, etc., apply at the Company's Office, Chicago, or 357 Broadway, New York.

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Through Sleeping Cars on 9:30 p. m. train from Chicago (C. M. &amp; St. Paul Depot), and from Milwaukee on 1:30 a. m. train for Green Bay, Menasha and Stevens Point. Sleeping car at Milwaukee ready at 8:30 p. m.

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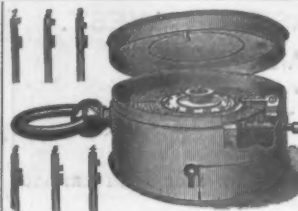
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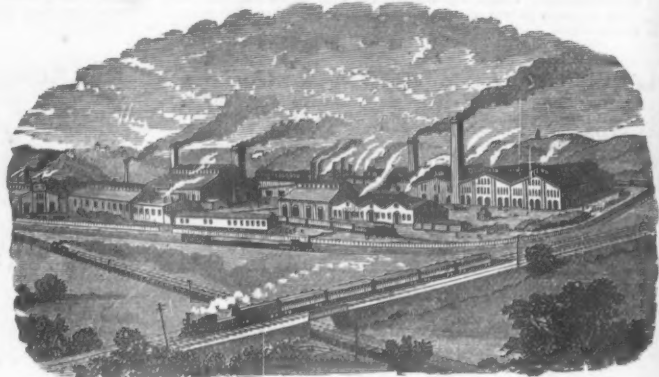
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BOSTON & PROVIDENCE RAILROAD CORPORATION,  
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A. A. FOLSOM, Superintendent.

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BOSTON & ALBANY RAILROAD (Boston Division),  
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